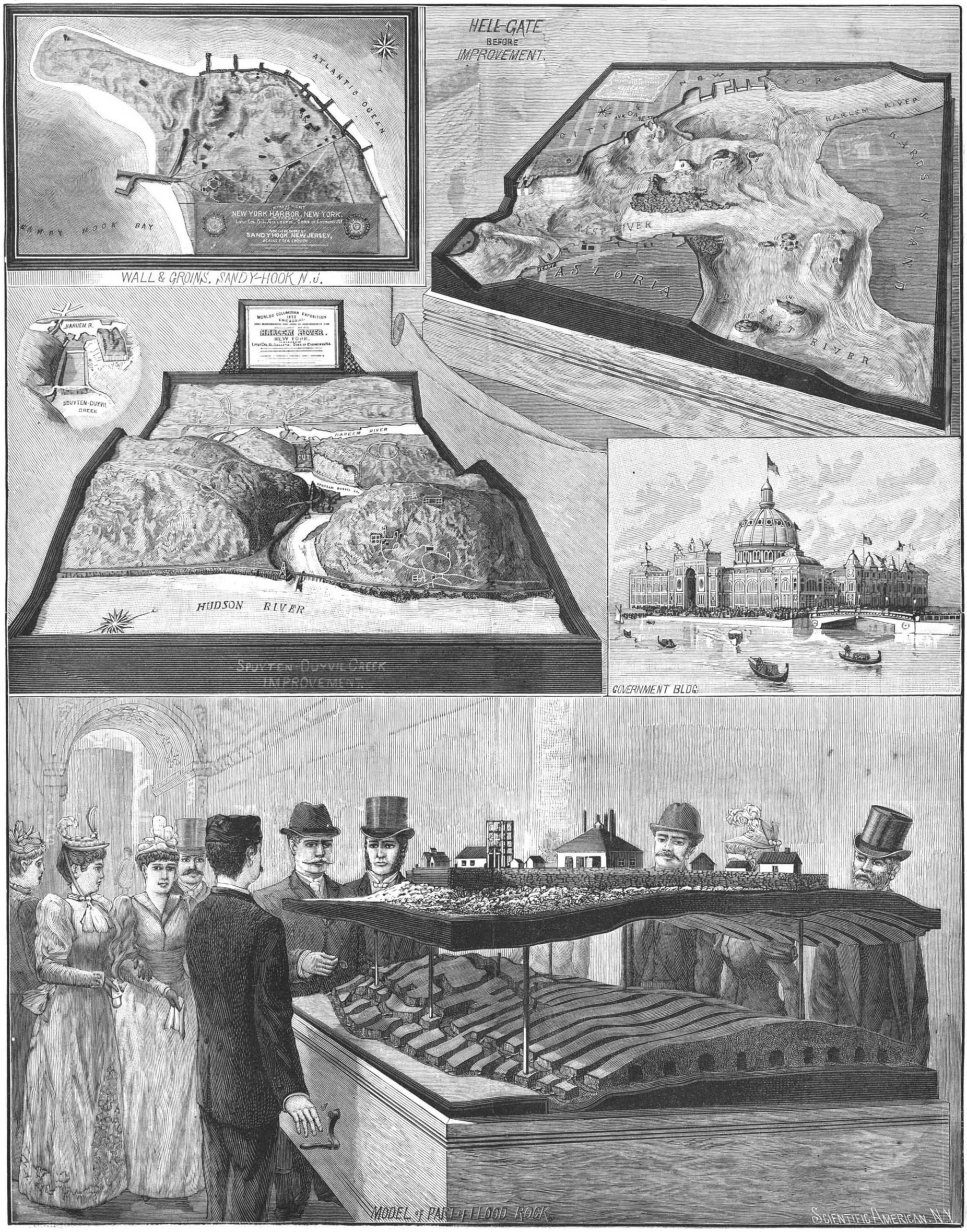
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1893, by Munn & Co.

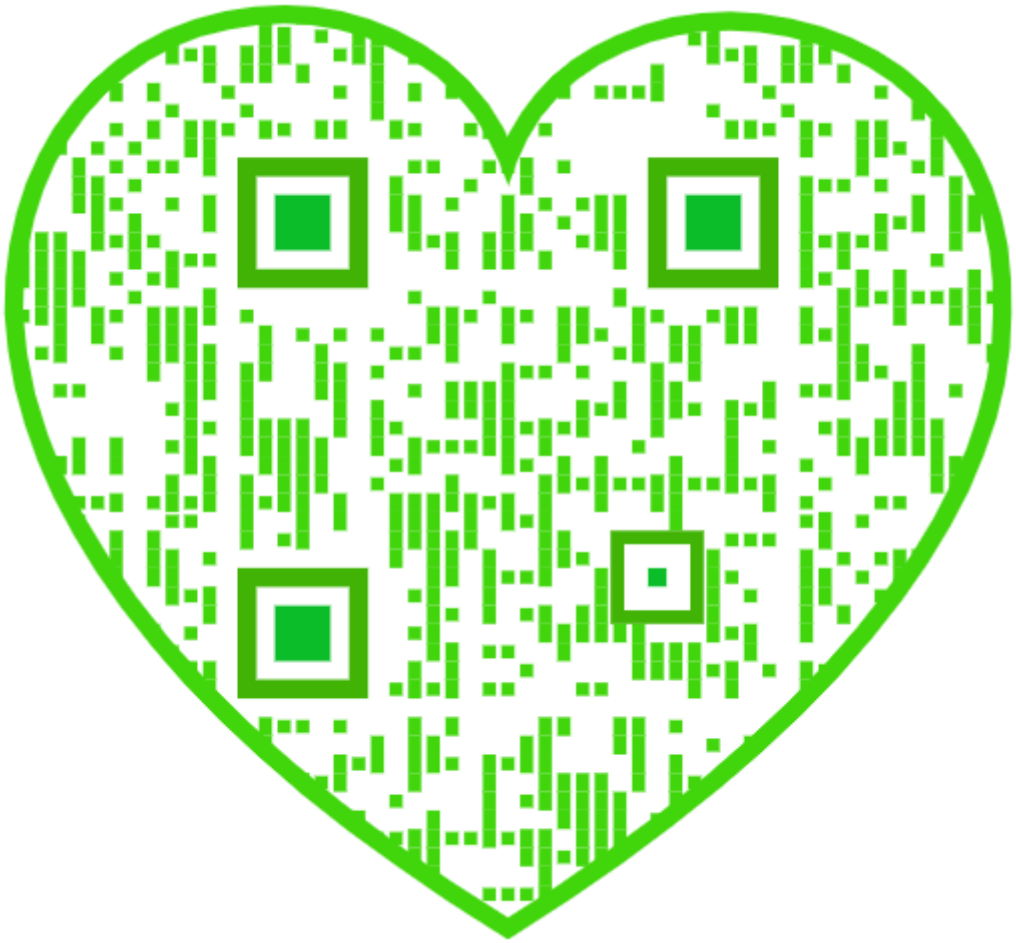
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXVIII.—No. 25. ESTABLISHED 1845. | NEW YORK, JUNE 24, 1893. | $3.00 A YEAR. WEEKLY.



THE WORLD'S COLUMBIAN EXHIBITION—UNITED STATES GOVERNMENT EXHIBITS OF RIVER AND HARBOR IMPROVEMENTS.—[See p. 391.]

© 1893 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *eight dollars and fifty cents a year*.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JUNE 24, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

Aerolite, fall of an..... 391
Agricultural inventions, the latest..... 394
Battle ship Massachusetts, launch of the..... 386
Bicycle stand, Whipple's*..... 388
Cave, the largest..... 390
Chemistry, economies wrought by..... 388
Chicago enterprise..... 389
Desk attachment, Neff's*..... 389
Effigies, intaglio, Wisconsin*..... 390
Electrical devices, new..... 394
Exposition building for Lyons, France, 1894*..... 388
Exposition, Columbian, government exhibits—River and harbor improvements*..... 385
Exposition, Columbian, Japanese at*..... 392
Exposition, Columbian, notes from the..... 387
Exposition, Columbian, Viking ship for the*..... 393
Fever annunciator, a..... 393
Gate, Williams'*..... 389
Gas or electricity, relative economy of..... 390
Hell Gate, East River, before improvement*..... 385
Inventions, recently patented... 394
Knife, a Nubian, at Columbian Exposition*..... 390
Light, refraction and dispersion of*..... 392
Mining improvements, recent.... 394
Paint, the blistering of 393
Paint, composition..... 392
Patents granted, weekly record of 395
Photography and art..... 386
Photography as an aid to art.... 392
Plow attachment, Petch's*..... 389
Pinch bar, McDonald's*..... 388
Press, hydraulic car wheel*..... 389
Rails, steel, very cheap..... 388
Rails, testing 100 pound..... 393
Railroad station, new, Philadelphia..... 392
Railway appliances some new... 394
Railway elevated, Naples..... 389
Sandy Hook, map of*..... 385
Ships, the old and the new..... 386
Spuyten Duyvel improvment*.... 385
Timber preservative, naphthalene..... 391
Tin, where it comes from..... 391
Tree growth, a curious*..... 390
Vessel stopping device, Samolhod's*..... 388
Viking ship, the*..... 393

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 912.

For the Week Ending June 24, 1893.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ASTRONOMY.—The Velocity of the Stars.—Practical application of Fizeau's method, as carried out at the Paris Astronomical Observatory.—3 illustrations..... 14576

II. BIOGRAPHY.—A Young Musician.—A wonderful eight year old prodigy.—Koczalski, the Polish wonder child, with portrait.—1 illustration..... 14577

Frederick Augustus Genth.—A biography of Prof. Genth, the great chemist, for many years identified with Philadelphia and the University of Pennsylvania..... 14577

III. CIVIL ENGINEERING.—The New Port of Tunis.—Harbor works converting Tunis into a sea port.—A great achievement by the French engineers.—6 illustrations..... 14568

IV. ELECTRICITY.—Alloy by Electro-Deposition.—Note on the electrical production of a silver alloy for plating purposes..... 14571

Luminous Discharges in Electrodeless Vacuum Tubes.—Recent experiments on high tension phenomena, with theory of the action..... 14570

The Bismuth Magnetic Field Explorer.—By Dr. TH. BRUGER.—A very compact and ingenious instrument for exploring magnetic fields.—3 illustrations..... 14571

V. MECHANICAL ENGINEERING.—Large Gas Engines versus Steam Power.—Increasing use of large gas engines for heavy class of work.—Their growing importance as competitors with steam engines..... 14569

Serpollet's Steam Artillery Wagon.—A steam-propelled wagon capable of carrying a load of ammunition weighing over 3,000 pounds, with tractive power for a second load of double this amount.—2 illustrations..... 14570

VI. METALLURGY.—Galvanizing Iron and Steel.—Note on a modification of the galvanizing process..... 14573

VII. NAVAL ENGINEERING.—Mr. Vanderbilt's New Yacht.—Dimensions of the Valiant, recently launched on the Mersey.—1 illustration..... 14570

VIII. PHYSICS.—The Royal Society Conversazione.—Interesting exhibits, principally in electricity, as shown at the Burlington House.—6 illustrations..... 14571

IX. TECHNOLOGY.—How Cigars are Made in France.—A very interesting and popular article on the manufacture of cigars, with illustrations of all the different processes employed therein.—13 illustrations..... 14574

Losses in Sugar Making.—Notes on sources of loss in the manufacturing of sugar as conducted in Louisiana..... 14573

The Manufacture of Vegetable Oils.—Interesting notes on the oil industry as conducted at Marseilles..... 14572

THE OLD AND THE NEW SHIPS.

On another page we publish an illustration of the recently arrived Viking ship, as she would appear in mid-ocean, speaking a modern steamer. The picturesque little craft, of model which has been pronounced almost perfect, with her gayly striped sail, decorated stem and stern posts, and her rows of shields on either side, is seen driving before the wind toward her port. Back of her looms up the giant form of a modern steamer, bringing together the naval architecture of to-day and that of ten centuries ago. The crossing of the ocean by this little craft adds to the probability that the Norwegians did make their way across the Atlantic Ocean in olden times, and that Columbus crossed a sea which had been traversed some five centuries before by the hardy Norsemen. The trip is one of peculiar interest. As a model for the ship the famous Gokstad ship was at hand; this was followed as closely as possible in the construction. Thus a great advantage obtained over the Spanish caravels. They had to be made up from early pictures and descriptions only, there being in existence no remains of a genuine caravel. Before leaving Norway, the Viking ship cruised about the coasts a little, and was found to be an unexceptionable model, and a trip across the ocean with a picked crew was confidently undertaken. It is in this achievement that the interest of the voyage is found. While the caravels had only been experimented with under sail, and were prosaically towed across the Atlantic from Spain, the Viking ship started at once on her long voyage without the assistance of a steam vessel to tow her and without escort or convoy of any kind. Taking advantage of favoring winds, tacking as well as possible when the winds opposed her, lying to in gales or scudding before them, she comfortably made her way across the ocean in a little over one month.

Our illustration shows vividly the difference in size between the old and the new ship. A modern vessel may be nearly as wide as the Viking ship is long; the Viking ship could be dropped end-first into one of the funnels of the Campania and be completely ensconced therein with 40 or 50 feet to spare. The modern ship driven by from 10,000 to 30,000 horse power covers every day from 400 to 530 marine miles. The Viking ship with her single sail of 200 square yards area, supplemented by a small jib, was thought to do remarkably well when she covered a little over 200 miles in a day's sailing.

In the absence of a sail the Viking ship was to be propelled by oars; the aggregate horse power which this method of propulsion would represent could not well exceed a sustained average of 3 or 4. This brings out in still more startling relief the difference between the old sea dragons, about which their poets and historians grew enthusiastic, and a modern businesslike liner, which under the impulse of thousands of horse power completes her voyage with the expenditure of a ton of coal for every four or five minutes of her progress.

Many stories are related of the ancient Viking ships which were, in many instances, little better than piratical craft. Of one of their commanders it is told that he could walk upon the shafts of the oars projecting from the sides; one ship is said to have been so large that a warrior standing on her bottom could hardly touch her beams with uplifted battle ax, yet the single chimney of a modern ship is a far greater structure than were these old themes of admiration of the northern bards. The greatest of the Viking ships would be consumed in an hour in the furnaces of an ocean steamer. The old ships were buried with their warrior commanders as a fitting coffin or sarcophagus. The modern iron ship finds her grave only in the sea if she is wrecked, our unpoetical age not thinking well of so expensive a sepulture as that which the steel ship of the day would provide.

LAUNCH OF THE BATTLE SHIP MASSACHUSETTS.

On June 10, at 10 A. M., there was launched at Cramp's shipyard, at Philadelphia, the battle ship Massachusetts. This ship is a sister to the Indiana launched last March, and to the Oregon, which is not yet afloat. In every respect the launch was a great success. Before the men had cut through her upper ways she broke loose, and two minutes before the start was anticipated she slid down the ways into the water. She was christened by Miss Herbert, the daughter of United States Secretary of the Navy Herbert. A national salute of 21 guns was fired in her honor, followed by a 17 gun salute for the Secretary of the Navy; and after speeches and inspection of the ship a quartermaster was detailed to strike the ship's bell, presented by the 7th Regiment of New York City. It is said that it was the most ceremonious launch that ever occurred at the yard.

This ship is the second of three ships of 10,200 tons burden, commenced during Secretary Tracy's *regime*. She is very heavily armored, the water line belt being 18 inches thick and extending along three-fourths of the ship's length. Turning in forward and aft around the base of the redoubts, it extends 3 feet above and 4½ feet below the water line. The turrets and redoubts are 17 inches thick. Above the belt of armor the side is protected by 5 inches of steel; one deflecting steel protective deck is provided in addition to steel decks above it, also of sufficient thickness to afford a measure of protection. Her conning tower is armed with 10 inch plates. A military mast is provided, carrying two tops for rapid-fire and machine guns. The hull is cut up by water-tight bulkheads, has protective coal bunkers, and is protected by cellulose or cofferdam from leakage if perforated.

In her armament she is of the most powerful class; at a single discharge she will be able to throw 6,800 pounds of projectiles. Her battery is to include four 13 inch rifles, eight 8 inch rifles, and four 6 inch rifles as the main armament in addition to her secondary battery of light rapid-fire pieces. She is to carry six torpedo tubes, one at the bow, one on the stern and two on each side, for 18 inch Whitehead torpedoes. She is to develop a horse power of 9,000 and a speed of 15 knots. She is the second of the three ships built by the Cramps. The third ship, the Oregon, was assigned to the Union Iron Works, of San Francisco. The contract price for the Massachusetts and the Indiana was $3,020,000 apiece; for the Oregon the bid was $3,180,000.

The Relation of Photography to Art.

M. Robert de la Sizeranon has an excellent article on the subject, "Relation of Photography to Art" in the mid-February number of the *Revue des Deux Mondes*, translated into *The Review of Reviews*. He dwells, first, on the service photography has rendered to painters in enabling them to study correctness of detail. The conventional landscapes, the complicated architectural backgrounds, the "ideal" and impossible forms of men and horses, have all disappeared. The whole art of "historic landscape" has been relegated to the Valley of Lost Lumber. In perspective, photography has made it possible for us to appreciate more accurately the size of figures in different planes. Most painters before the rise of photography will be found to have given too much importance to the figures of their background or middle distances, relatively to those of the foreground—a mistake frequently made by amateurs in landscapes. Photography has also simplfied, to an astonishing degree, the production of panoramas. After noting the influence of photographs of distant countries in interfering with the production of fancy tropical landscapes and imaginary Eastern scenes, and the revolution it has brought about in the art of portraiture, M. de la Sizeranon goes on to discuss what may be expected of photography in the future. He devotes several pages to the discussion of Mr. Muybridge's instantaneous photographs of horses and other animals in rapid motion, and inquires whether we are to accept the often extremely ugly and awkward poses shown in them as nearer reality than what the ordinary eye supposes itself to see. He thinks not—rather that the modern picture is a violent exaggeration; for it presents to us, immovably fixed, a position in which the animal only remained for so incalculably minute a fraction of a second that to the eye it blended with the position immediately following it, and so formed part of a harmonious motion. Every movement consists of a succession of poses, each lasting so infinitesimally short a time that we see none of them separately. What we do see (when the motion is not too quick to let us see anything distinctly) is a generalized representation of the whole, a kind of composite photograph, so to speak; and an approximate picture of this is nearer the truth than any number of instantaneous photographs of separate poses. It is, however, a distinct gain that the classic charger at full gallop, with all four legs extended in the air at once, who never existed on earth save in battle pictures, should finally have been hunted and driven from the field, as Mr. Muybridge has had some share in doing.

Photography is growing more perfect every day; even the great color problem seems to be as good as solved at last. M. Lippman has succeeded in producing several very successful photographs in colors, by availing himself of the laws of interference of light. Last spring, at the International Exhibition of Photography at Paris, he exhibited a picture of an Ara parrot (blue and yellow), and a branch of holly; at a later date he succeeded in producing a stained glass window in four colors, a group of flags, a plate of oranges with a red poppy, thus almost completing the chromatic scale. He uses a mirror, a film of gelatino-bromure, and a little mercury.

It may be said that, since this last step has been taken, photography leaves nothing for the painter to do. If it were true that the only object of art is the mathematically accurate reproduction of the world around us, this argument would be unanswerable, and the "realist" school, who maintain this position, are beginning to find that they have no *raison d'être* whatever. There remains, then, nothing for artists to do but turn their attention to those (of late somewhat neglected) regions which the camera cannot reach; and we may consequently expect a new development of imagination and idealistic art.

© 1893 SCIENTIFIC AMERICAN, INC

The crowning feature in the Electrical Palace is the Tower of Light, a memorial to Mr. Edison and to his inventions, which have so perfected electric illumination. Every evening that the Exposition is open this tower is illuminated, and the fascination of watching it keeps a crowd of people constantly in the building. The colors change from one to another, chasing each other up the shaft, dazzling the eyes with its brilliancy. The tower is 82 feet high and is studded with six candle power lamps to the number of five thousand.

The Bell Telephone exhibit is a study, as in this pavilion is shown a full set of the models that were made by Mr. Bell, thus giving in complete detail the gradual development of this instrument. In addition to all these models are many of the latest improved telephones, and across one side of the pavilion is a model telephone exchange which is the "central" of the Exposition grounds. This exhibit is crowded at all times by people watching the young women make the connections on the switchboard.

Adjoining the Bell Telephone pavilion is the exhibit of the Western Electric Company, which is very complete and contains several features which have been revelations to the public as to what electricity can do in the way of lighting. The chief feature of this exhibit is a pavilion of Egyptian architecture, which is illuminated in the interior to show the soft and perfect results that can be obtained with electric light, and to at the same time display many of the smaller manufactures of this company. Adjoining this structure is the Tower of Lightning, as it is frequently called. This is a shaft studded with over 2,000 incandescent lamps, red, white and blue, which wind around the shaft from its base to the ceiling of the gallery above. From the top four lines of lamps containing the three colors branch out in different directions, each having a forked course like a streak of lightning. At the ends of two of these lines of light are large globes, also studded with colored incandescent lamps, while at the other two ends are clusters of lamps. The light begins at the bottom of the shaft, ascends with much rapidity to the top, splits into the four sections running along the rows of lamps over the zigzag course to the ends. When the light reaches the globes and clusters it becomes white, changes in an instant to red, then to blue. The instant the light disappears from these ends it begins again at the base of the shaft. The fascination of this exhibit is quite irresistible, especially as the automatic revolving switch, which controls the electrical current, is open to view by means of an open well, the switch being under the floor. There is nothing complicated or elaborate about this switch, and the majority of visitors who study it for a minute go away feeling quite content with themselves that they have for once comprehended the manner in which electricity is controlled. Another exhibit by the Western Electric Company is the electric finger, which writes, and as it writes illuminates, a series of letters spelling out, letter for letter, "W. E. Co.," in colored lamps.

The General Electric Company occupies by far the largest amount of space in this building, and makes a complete exhibit of dynamos of all kinds and motors which will be intensely interesting to students in electricity because of the advancement shown by the many models of early types of these machines. Either in this or in other exhibits are models of nearly all of the types of dynamos that have been made since the old Farmer dynamo, which is exhibited by the Ansonia Electric Company in the north gallery. An attractive feature of the General Electric and other exhibits is that of arc lamp poles, many of which are very artistic in design, and which give hope that the time is not far distant when the ungainly-looking poles now seen so frequently in use for street lighting purposes will give way to something more artistic. In this same exhibit is shown the development of the incandescent lamp, beginning with the very earliest experiments of Mr. Edison and ending with an infinite variety of these lamps as now made. This includes miniature lamps in every conceivable shape and design, and lamps of all candle powers from a mere speck of light to 250 candle power.

The Westinghouse Electric and Manufacturing Company occupies a large space and exhibits a complete line of machines, lamps, and other electrical apparatus and devices. The pavilion occupied by this company is one of the most attractive ones in the building. It is decidedly artistic in design, is colored with rare taste, and, when illuminated in the evening, presents a beautiful effect. But to the average electrical man the main interest in the exhibit of this company will be in the display of dynamos made in the power plant in the Palace of Mechanic Arts. This exhibit includes six dynamos of a maximum capacity of 15,000 lamps each, three of which are direct-connected as has before been described in these columns. The switchboard which controls this incandescent lighting plant is a piece of workmanship both in effective design and in electrical conception that has probably never been equaled because of the enormous capacity of the plant.

The exhibit in the Palace of Mining that attracts the most attention is probably that of the De Beer's Consolidated Diamond Mines, Kimberley, South Africa, This exhibit faces the central aisle and is in the southern end of the building. At stated times each day, and usually for a period of two hours, of which notice is given beforehand, the process of diamond washing is fully shown. Tons of diamondiferous ground have been brought from the mines of this company, and each day part of this ground is crushed and washed and the work carried on in the same manner, though not on the same scale, that it is done in the mines themselves. The pavilion containing this exhibit is mostly of glass, so that the whole operation can be fully observed. In the end of the pavilion facing the central aisle, Tiffany & Co. of New York have several men at work cutting and polishing the stones, and there is a constant crowd of people watching this operation. In one corner of the pavilion is quite a pile of ground showing the diamonds in the matrix and the diamondiferous ground. There is also a fine exhibit of diamonds cut and uncut. The largest uncut diamond that is shown weighs 282 carats. The mineral exhibit of the Cape Colonies is immediately back of this diamond exhibit. In this exhibit there is also shown considerable diamondiferous ground together with coal, copper, and other minerals from these colonies. The display of crocodolite is particularly fine. This beautiful mineral is wrought into charms and ornaments in great variety, also into knife handles, medallions, etc.

In the Oregon display is another exhibit that attracts much attention. It includes a working model of a gold placer mining outfit. A large amount of gold-bearing dirt is at hand for demonstrating the whole process of panning out the gold and at stated intervals the plant is put into operation. This exhibit is not surrounded with glass, and it is an amusing sight to see people hunting over the sand and dirt for particles or appearances of gold.

The latest achievements in the construction of railway rolling stock for passenger service in Europe and in North America are fully shown by an exhibit which stands nearly in the center of the annex to the Transportation building. Here are two trains of cars with engine attached. One is exhibited by the London and Northwestern Railway, the other by the Canadian Pacific. The engine attached to the English train is the Queen-Empress, and it has a record for high speed. It is a compound engine of the Webb type, the one low pressure cylinder being in the saddle and the two high pressure cylinders being on the outside, located as usual on engines. This engine has a pair of drivers on each side 7 feet 1 inch in diameter. It is severely plain and much resembles in effect the type of engine illustrated on the front page of the SCIENTIFIC AMERICAN of May 27. Two cars are shown with this engine. One is a compartment car of the English type, the other is a sleeping saloon. These cars are finished in dark blue on the exterior, while the interior of the several compartments is finished in different colors and qualities of material, according to the class. The doors to the cars are open, so that sight-seers can look in, but people are barred from entering the cars.

On the track adjoining the one on which this English train is shown is the train exhibited by the Canadian Pacific Railway. This consists of engine No. 625 and a train of five vestibuled cars. The engine is a monster weighing 213,000 pounds and having three coupled drivers, each 69 inches in diameter, on each side. The engine and cars were constructed in the shops of this company The cars are heated by steam and lighted by electricity. The exterior finish of each car is of highly polished mahogany. Immediately back of the engine is the baggage car, next comes the second-class car, upholstered in leather and finely finished in natural wood. In arrangement it is like an ordinary sleeper and it is fitted with smoking compartment, lavatory, etc. The third car is a day coach finished in white mahogany and plush of copper red, while the smoking room is finished in old oak and olive corduroy. Then follows the dining car, fitted with tables for four people on one side of the aisle and for two people on the other side. This car is finished in white mahogany and old oak and upholstered in leather. The last car on the train is a sleeper finished in white mahogany, bronze metal work and paneled ceilings; the upholstery is sage green plush. In addition to the berths there are two state rooms, a bath room and a large smoking room, together with the other usual accommodations.

Nothing can be much more instructive in the Transportation building than these two exhibits which stand side by side. They need not call out comparisons, because of the entire difference of the service for which each was designed. The English train runs on as perfect a roadbed as can be made, is designed to make high speed and has no sharp curves to turn. The Canadian Pacific train has a much less perfect roadbed, is designed to make the trip across the continent from ocean to ocean if need be. It must make sharp curves and the engine must have capacity to haul this train up any grade and at the same time be able to make long runs at a speed of 60 miles an hour without overstraining. This train is open to the public inspection.

June 13 was the last day spent by the Infanta in Chicago. During it she visited the Fair, and her visit thereto was signalized very appropriately by the dedication of the Spanish building in her presence, and on the same day the Spanish exhibit in the Manufacturing building was formally opened to the public. On June 14 a special train left Chicago for New York, carrying the Infanta and her suite. It made a run of 514 miles in a fraction under 11 hours, maintaining a speed, exclusive of stops, of 50 miles an hour, a very remarkable achievement for so long a distance. Another interesting incident connected with her visit was the attention bestowed by her on E. D. Libbey, the proprietor of the Libbey Glass Works, who is said to have been made official glass cutter by the Infanta. On the same day, at 5 40 P. M., the great cowboy race was started from Chagron, Nebraska. At the pistol shot, and witnessed by a thousand people, nine riders started on the long race, the World's Fair being the terminal point. They are to complete the ride, each man on the same horse, and a prize of $3,000 is to be given to the winner. In addition a special prize for bringing their horses through in good condition is included for the riders.

On June 14 Signor V. Zeggio, the Royal Italian Commissioner for Liberal Arts, formally opened his section. The magnificent exhibit of jewels of Tiffany & Co. was opened the same day. It includes the two largest yellow diamonds in the United States, in addition to the very remarkable strings of pearls and other mineral objects which were seen and admired by so many people in this city before the exhibit left.

The great Ferris Wheel is now rapidly approaching completion, and is to be opened on the 22d. It has cost about $250,000, and it is hoped that it will be as great a success in its way as was the Eiffel Tower in Paris. On June 15 the Fair had what was, up to the present period, its greatest day. The dedication of the Indiana and Arkansas State buildings and the opening of the interesting Java Village took place on that day, but while these would have been enough to signalize an ordinary day, they were minor matters compared with the German celebration. The day was termed the German day, and from all sides the railroads unloaded great crowds of representatives of the German nation, and the crowds poured into the park in such numbers that there was difficulty in getting them in fast enough. The German government building was, of course, the center of attraction, and next to this came the Midway Plaisance. Speeches, music, an immense procession, and gymnastic exhibitions by the Turner societies were among the special features of the occasion. At last all the witnesses seem to have settled on the conviction that the Fair for one day proved itself an absolute success. Hitherto there has been a tendency to criticise the management and to be very severe on anything partaking of an unfavorable aspect; but on Wednesday the Fair seems to have redeemed itself in the eyes of all, and it now looks as if, with large attendance and reduced expenses, the Fair might be made, comparatively speaking, a financial success.

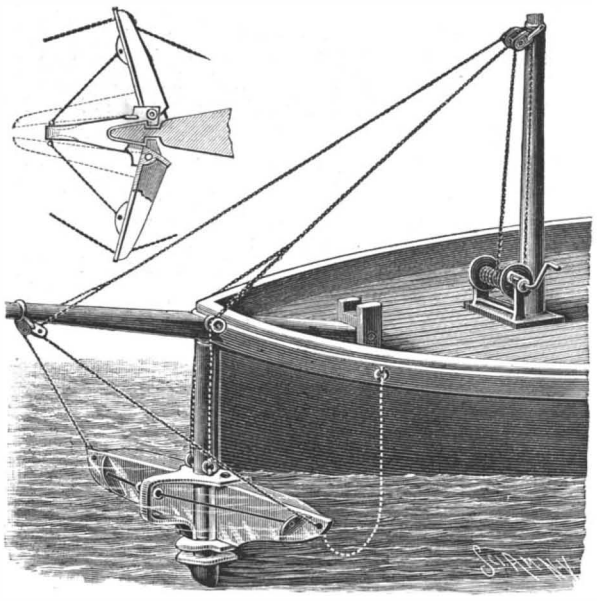
Its expenses so far have been very heavy; the salary list for May reaching the total of $850,000, divided among 6,000 employes. This is recognized as far too great, and the Director of Works, it is announced, has decided to drop 3,000 men from the pay rolls. The attendance is rapidly increasing, and it looks as if the daily average would soon be 100,000. On Wednesday naturally the largest attendance took place, aggregating nearly 200,000 paid admissions, and a total attendance of about that number. Some interesting comparisons with the attendance at the Centennial Exposition at Philadelphia have been made. During May, 1876, the average attendance of the Centennial Exposition was 19,945 per day; at Chicago during May, 1893, the attendance was 36,060. At Philadelphia the attendance for June and July was nearly identical; August showed an increase of nearly fifty per cent, while September and October showed an immense increase, the total attendance aggregating over three times that for the months of June and July. For November there was of course a large falling off. It follows that for Chicago everything is to be hoped in the future three months. The arrangement of concessions in Chicago has been admirably conceived. From them

© 1893 SCIENTIFIC AMERICAN, INC

an enormous sum will be received by the Fair managers to be devoted to the expenses of the Exposition. It is impossible, therefore, to say whether or not the Exposition will pay expenses, but it seems a very safe prediction that from a proper point of view it will be far from a failure. It has been calculated that any attendance over a daily average of 100,000 will represent the profits of the Exposition, and there is every reason to believe that such an attendance may be realized.

A VESSEL STOPPING DEVICE.

The illustration represents an improvement designed to facilitate the quick stopping of a vessel moving in dangerous places, or in danger of colliding with another vessel, an iceberg, etc. The invention has been patented by Mr. Pedro Samohod, Nazarenas 145, Lima, Peru. A vertically sliding frame on a post at the bow of the



SAMOHOD'S VESSEL STOPPING DEVICE.

vessel has on its sides pivoted wings adapted to expand transversely to offer resistance to the forward motion of the vessel in the water when the frame is in its lowermost position. The wings are held in extended position by means of chains attached to a forward projection of the frame, and, to prevent accidental closing, other chains connect the free ends of the wings with the sides of the vessel. The frame is raised and lowered by chains or ropes leading upward over pulleys on the bowsprit to a common chain passing over a sheave on the mast and thence to a winch on the deck. To close the wings, chains connected to their outer ends pass over sheaves near the outer end of the bowsprit, thence to a common chain passing over a sheave on the mast and to the winch, the operation of which closes the wings, as indicated by dotted lines in the small figure, simultaneously with the raising of the frame and its wings out of the water. The winch is preferably provided with a locking mechanism under control of the officer in charge, on the bridge or other place, so that the frame may be quickly released, the chains rapidly unwinding as the frame drops to place of its own weight, the wings at the same time spreading out.

EXPOSITION AT LYONS, FRANCE, IN 1894.

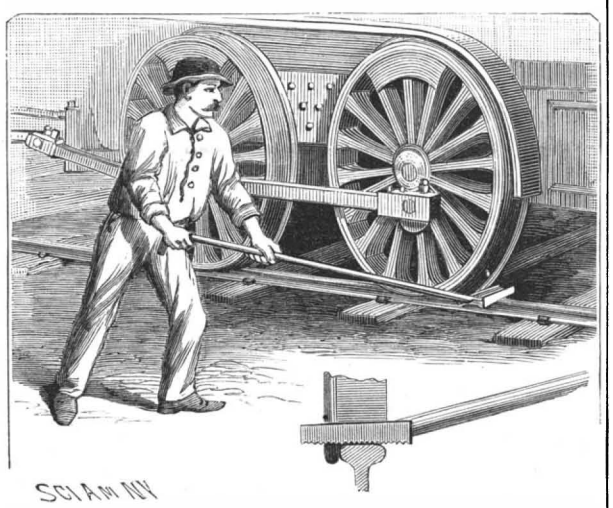
Arrangements are being rapidly pushed forward for holding an Exposition at Lyons next year. The fair is to be opened on April 26, 1894, and the accompanying engraving, issued by the official bulletin of the Exposition, shows the plans for the principal building. It is to be polygonal in shape, with a lofty central dome which will rise to a height upon the interior of some 180 feet. It rises in a graceful curve, the structure being strengthened by means of the airy lateral supports which resemble the flying buttress of a Gothic cathedral. The work is being carried on from designs of Messrs. Claret & Grenier, the engineers in charge. The building will be 760 feet in diameter, and will cover a space of nearly 500,000 square feet. The total weight of the entire structure will be only about 2,480 tons.

Economies Wrought by Chemistry.

Chemists turn scrap iron into ink, old bones into lucifer matches, the shavings of the blacksmith's shop into Prussian blue, fusel oil into oil of apples and pears, the drainings of cow houses into fashionable perfumery, beggars' rags into new pilot coats, cesspool filth into ammonia, and tar waste into aniline dyes and saccharine. In Paris they first utilize rats to clear the flesh from the bones of carcasses, then kill the rats, use up their fur for trimmings, their skin for gloves, their thigh bones for tooth picks, and their tendons and bones for gelatine wrappers. These are a few of the things *Iron Industrial Gazette* names among the products converted into use by the chemist and inventor.

AN IMPROVED PINCH BAR.

This bar is especially adapted for moving locomotives and railway cars, or for turning a wheel thereof, when there is no other power convenient, its construction being such that it may be conveniently used when at right angles to the track and wheel, the bar being made to pinch upon the flange and not upon the tread of the wheel. The improvement has been patented by Mr. John McDonald, of Tokio, Japan (Railway *Shinbasi*). As more distinctly shown in the side view, representing the bar applied to a rail and wheel, the foot is practically rectangular in cross section, and both its upper and lower surfaces are dished to produce central longitudinal depressions, with knife-like side edges on the top, while the under side edges form flat side ribs, which may be smooth or roughened, or have serrations or teeth produced in them. The upper

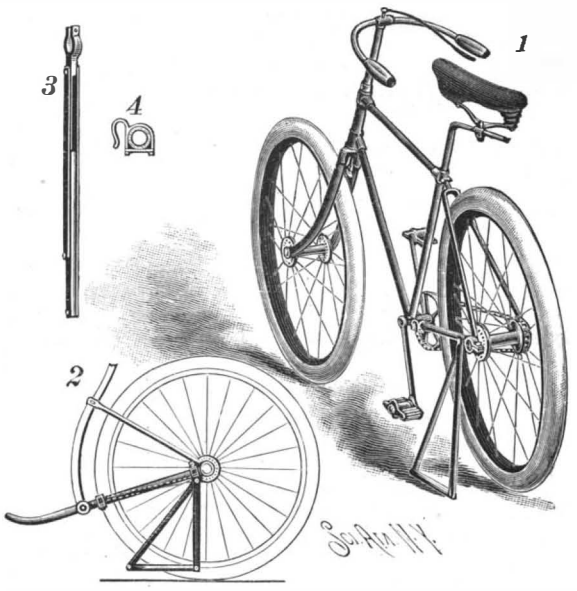


McDONALD'S PINCH BAR.

knife edges engage with the flange of the wheel, and the ribs rest transversely on the tread of the rail. The handle is bent downward at its outer end, forming a protection for the hands in case the bar should slip, and also has a ring, by which the bar may be hung up. The bar may be quickly and conveniently manipulated, and is designed to afford a much more powerful leverage than that obtainable with the old form of bar.

A CONVENIENT BICYCLE STAND.

The illustration shows a very cheap and convenient stand, readily applied to any bicycle, which may be carried about without inconvenience, and at any time dropped into position to sustain the wheel without compelling the rider to hunt around for a fence or other support. It has been patented by Mr. Clayton J. Whipple, Nos. 270 and 272 Wabash Avenue, Chicago, Ill. Fig. 1 shows the stand in open position attached to a man's bicycle, Fig. 2 showing its application to a woman's wheel, and Fig. 3 being an edge view of it in collapsed position. It has two swinging side pieces, one longer than the other, and at their upper ends is pivoted a clamp with a socket to receive the axle or step of the rear wheel of the bicycle, or to receive the side bar of the frame, the clamp being made fast by a screw or bolt. The base of the stand consists of a flat slotted rod pivoted at the lower end

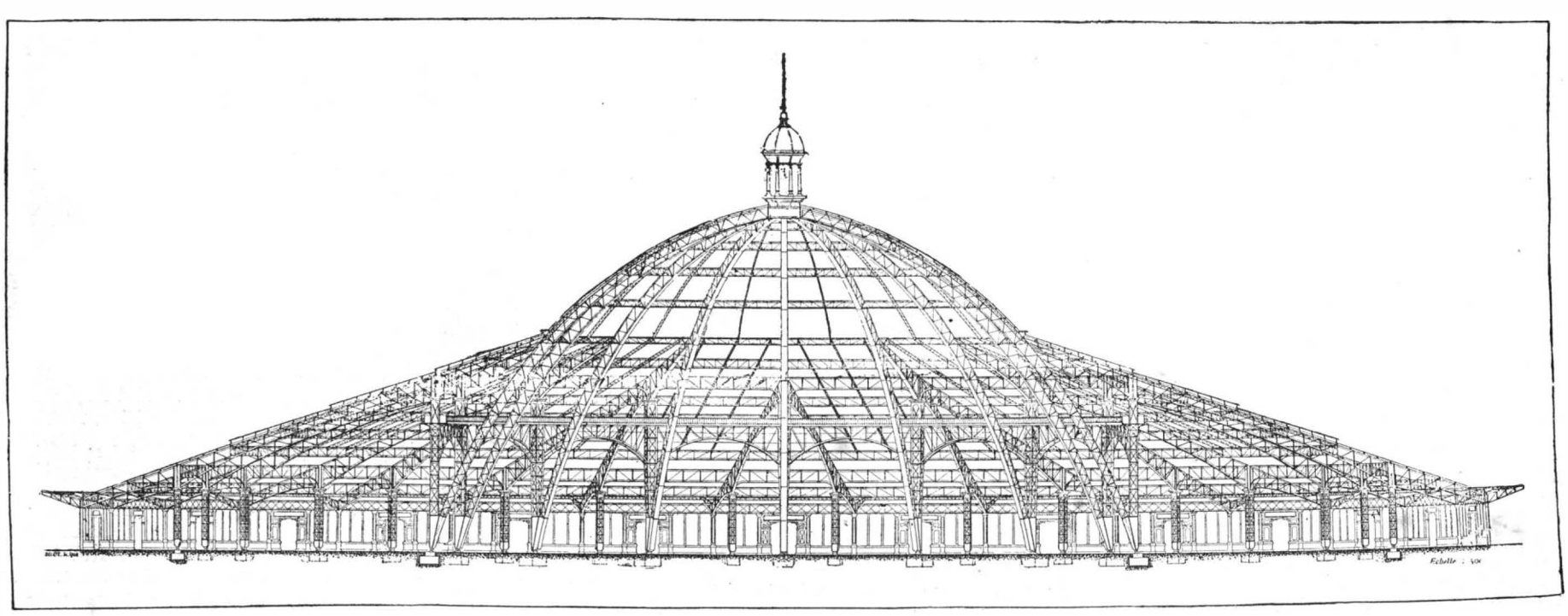


WHIPPLE'S SAFETY BICYCLE STAND.

of one side piece, a pivot pin on the lower end of the other side piece passing through the slot, so that the three pieces fold together in parallel position, and when open assume a triangular shape, giving great strength in proportion to its weight. When applied to a man's bicycle, and swung up into folded position parallel with the side bar of the frame, it may be thus retained by any suitable fastening device, a simple form of clip for such purpose being shown in Fig. 4. When the stand is released from the catch and dropped down it opens of itself, allowing the bicycle to lean slightly upon it, but forming a secure support therefor. For a woman's wheel the clamp is preferably applied to the side bar of the frame adjacent to the rear axle, as it is not convenient to secure the clamp to the axle.

Steel Rails Very Cheap.

Mr. Andrew Carnegie says: "The robber baron has ceased to rob, and is now being robbed. The eighth wonder of the world is this—two pounds of ironstone purchased on the shores of Lake Superior and transported to Pittsburg, two pounds of coal mined in Connellsville and manufactured into one and one-quarter pounds of coke and brought to Pittsburg, one-half pound of limestone mined east of the Alleghenies and brought to Pittsburg, a little manganese ore, mined in Virginia and brought to Pittsburg, and these four and one-half pounds of material manufactured into one pound of solid steel and sold for one cent."

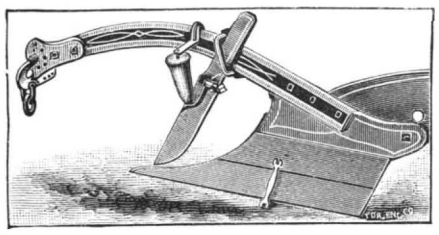


THE FRENCH UNIVERSAL INTERNATIONAL AND COLONIAL EXPOSITION AT LYONS, 1894.

© 1893 SCIENTIFIC AMERICAN, INC

PETCH'S PLOW ATTACHMENT.

The device illustrated in the accompanying cut is intended to prevent injury to such crops as turnips, carrots, beets, etc., when the fields are being plowed. It consists of a clearing roller, designed to be attached to the colter or cutter blade of an ordinary plow and mounted at an angle thereto and in front of the cutter, so that as the plow passes through the surface of the ground the roller will push to one side any bulbous roots that may be met with, and will prevent their being injured by coming in contact with the cutter blade when the field is being plowed up. The roller also serves to turn over the ground as the plow passes over it, and it also serves to prevent foreign material from collecting and clogging the colter.



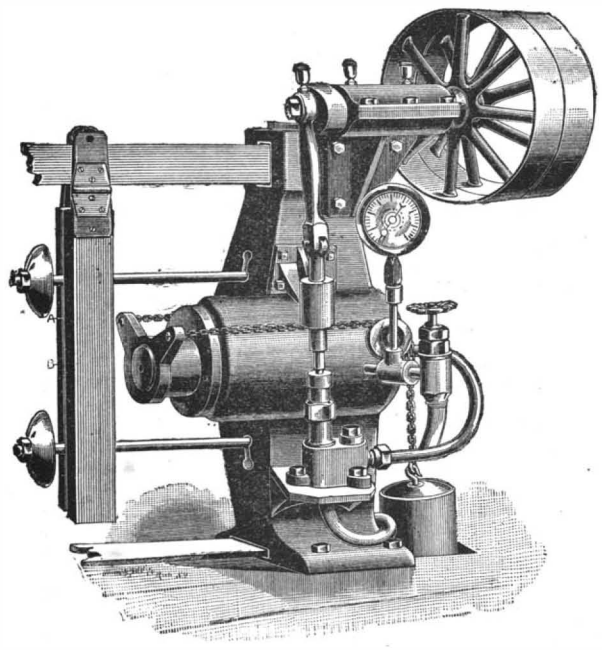
PETCH'S PLOW ATTACHMENT.

Mr. Arthur John Petch, of Aurora, Ontario, Canada, who is the patentee of this attachment, makes the roller preferably conical in shape with the largest part at the top, and it is mounted upon a spindle, upon which it rotates freely. It is attached to the plow by means of two brackets, one of which is bolted to the beam of the plow and the other to the cutter blade. It is freely adjustable thereon, and may be attached to any form of plow.

AN IMPROVED HYDRAULIC WHEEL PRESS.

The illustration represents the head end of a single pump hydraulic car wheel press. The bars, A and B, together with the heavy bolts passing between them and extending through the cylinder arms of the machine, are used only by electric railway companies for pulling pinions and gears. They will resist 30 tons pressure. The parts of the machine not here illustrated consist of a traveling crane or saddle having adjustable hooks for holding shaft or axle, a suitable yoke (abutment beam) which is suspended on rollers so as to be easily moved back and forth, also a foot piece having a side opening at its center so as to admit of placing a long shaft in the machine by allowing it to extend beyond the foot piece. This machine is manufactured by the J. T. Schaffer Manufacturing Co., Rochester, N. Y., and is used for removing and pressing on car wheels and engine drive wheels, also for general use in machine repair shops where great pressure is required.

It can be operated either by hand or belt power, is made in various sizes for swinging wheels from 36 inch to 84 inch in diameter and for generating from 30 to 300 tons pressure. The larger machines are constructed with double pump. The rams of the various sizes of this machine are of standard diameter and length for



HYDRAULIC CAR WHEEL PRESS.

the requirements of each. The valves of the improved Schaffer hydraulic pump, used exclusively by this company, are easily opened. The crank shaft is steel and has a long bearing in Babbitt metal. This shaft is placed at right angle or parallel with the line of the machine to suit the purchaser. This company makes all its own fittings; they are extra heavy, and the workmanship and materials throughout are first class. The packings in pump and cylinder are such as to prevent leakage, are very durable and easily renewed. The lower tension bar being flatwise materially stiffens the line of pressure, also reduces the distance of raising wheels by about 4 inches.

Each machine has a standard gauge, safety coupling, and sealed water tank. As accompanying appliances to this machine (or which may be adjusted to other similar machines) this company has recently put on the market a car axle straightener which it is said can be put in position in less than one minute, and is claimed to be a very satisfactory device. It is also equally desirable for straightening shafts, or to use as a rail bender. The same company is also having a large demand for another device for street car repair shops, to be used on any hydraulic wheel press for removing old car wheels from the axle, on which a large gear is located near the wheel.

An Elevated Railway in Naples.

A remarkable scheme has been laid before the Syndic and Town Council of Naples for the construction of an elevated railway in that town, and a concession for carrying it out has recently been granted. The project is due to Signor Adolfo Avena. The railway will place the handsome and populous center of the town near to the Via Roma—in fact, the center of Neapolitan life and business—in communication with the Corso Vittorio Emmanuele, the San Martino Hill, and the elevated part of the town known as the new Rione del Vomero. The line will be carried on two metallic viaducts, one arranged at a higher level than the other and each having a double way. Each passage will be independent of the other, one forming a course for electric cars and the other being reserved exclusively for foot passengers. The first viaduct, of a length of 1,180 feet, will commence in a masonry tower 325 feet high, in the Via Roma, opposite the Via S. Brigida, and will terminate in the base of a second metallic tower 490 feet high, to be built in the Cariati Gardens in the Corso Vittorio Emmanuele. The second viaduct, starting out of this metallic tower a certain distance below its summit, will pass over the San Martino Hill and terminate on the level at the new Rione del Vomero. Thus the metallic tower will form the connecting link between the two viaducts, which will be carried on eleven pyramidical metal columns or towers having masonry foundations. The electric cars, after running along either viaduct, will be automatically placed upon the lifts for hoisting or lowering passengers, who, having once taken a seat in the car at one of the termini, will be conveyed to the other end of the line in eight minutes without the necessity of changing seats.

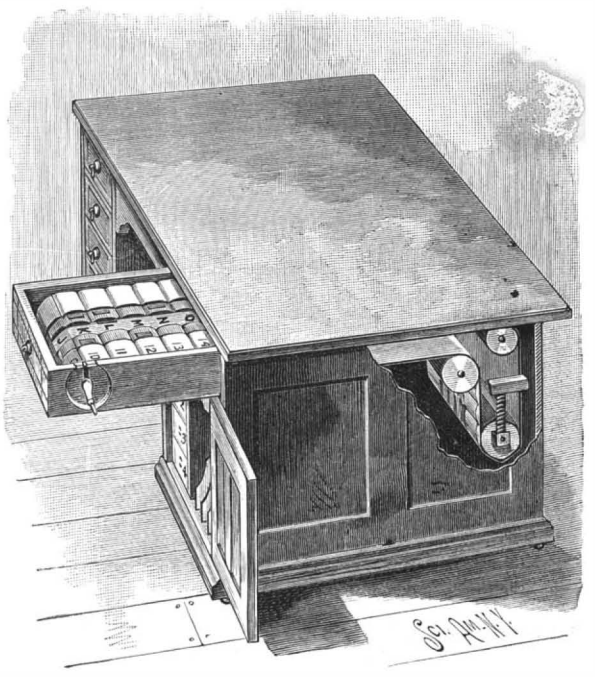
Chicago Enterprise.

Frequent instances, says the *Railway Review*, of what can be done on occasion have been recorded concerning Chicago, many of which entitle the city to pre-eminence, but one of the most remarkable exhibitions of energy was brought to completion early in the present month, when the largest grain elevator in the world, having a storage capacity of 3,680,000 bushels, was commenced on April 1 and finished and commenced business on May 3, a period of thirty-three days; having within one week from that time more than one million bushels of wheat in store. More than eight million feet of lumber were used in the construction of the building, which is of the ordinary crib style. The elevator is equipped throughout with electric lights and is completely furnished with all styles of modern machinery. From six to nine hundred men were continuously employed night and day in its construction. If any one knows of a quicker job, we should like to have it reported.

NEFF'S DESK ATTACHMENT.

Mr. John Wesley Neff, of Buckhannon, West Virginia, is the patentee of an improved form of library or office desk. It will be found of special convenience to those who have large numbers of papers or documents to be filed away, as they may be assorted and laid aside according to any convenient system of classification. A large number of papers may thus be preserved in a remarkably small space, as much of the room occupied is that located at the back of the desk, which is ordinarily wasted.

The desk may be made of any approved form of construction, the attachment being represented in the cut, which was prepared from a photograph, as applied to an ordinary business desk. The paper holder consists of an endless belt or apron which is provided with a double series of pockets opening toward each other and closed at the top and bottom so as to prevent the contents from falling out. The apron is preferably mounted in a sliding compartment or drawer and passes over rollers as shown in the cut. The two end rollers are polygonal in shape, the faces being equal in breadth to the width of the pockets, and they are corrugated so as to take hold of the apron when the actuating roller is rotated. The lower roller at the rear of the desk is spring-actuated, so as to take up the slack in the apron and so as to accommodate itself to the movement of the apron when the drawer is opened and closed. The apron is operated by means of a hinged crank handle which is located in an inset in the side of the drawer, and by means of which the upper polygonal roller is rotated. This crank handle is preferably located at the inner side of the drawer adjacent to the person seated at the desk. The top board of the desk may be hinged at the front side so that the back may be raised in case an inclined plane is preferred to write upon. A small drawer is sometimes located at the rear of the desk and under the lower roller to receive any papers that might accidentally be dislodged and fall from the pockets in the



NEFF'S DESK ATTACHMENT.

apron above. By means of this simple construction it will be seen that all the pockets may successively be brought into view.

AN IMPROVED ROAD GATE.

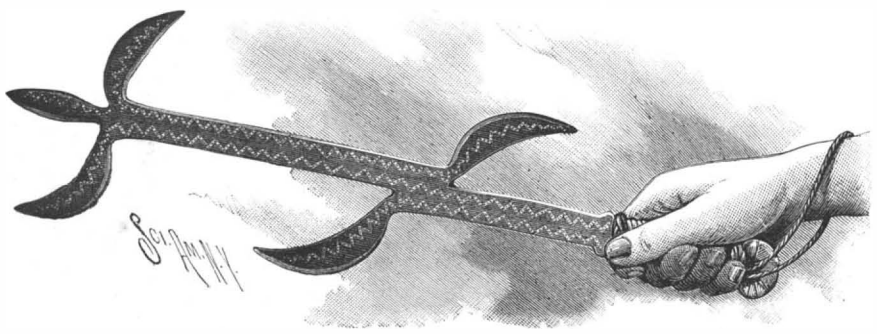
This is a gate which may be conveniently opened and closed from either side by persons on horseback or in vehicles, without alighting. The improvement has been patented by Mr. John H. Williams, of St. Vincent, Ky. The gate is pivotally connected by a link with a weighted lever fulcrumed on a pivot turning in a plate on the ground, at a little distance from the hinge post. The lever is also pivotally connected by an arm with two diverging chains or ropes connected with the ends of beams extending in opposite directions in line with the roadway, these beams being fulcrumed near the upper ends of posts at the side of the road on each side of the gate. From the outer ends of the beams hang ropes, to be drawn upon by the traveler on horseback, in a vehicle, or afoot, to open the gate, an upward pull on the arm connected with the diverging chains giving an outward swinging motion to the weighted lever, and the latter, as it passes the central vertical position, swinging the gate fully open, so that it rests against one of the posts at the side of the road. The arm connecting the weighted lever with the pull chains is also connected by links with the inner end of a latch bolt whose outer end is adapted to engage or disengage a keeper on the latch post, a spring on the gate assisting to throw the bolt as the gate is closed. The connection is such that the latch bolt is drawn at the commencement of the movement of the weighted lever, permitting the gate to swing freely open, and, after the traveler has passed through the open gate, a pull on the second rope causes an inverse movement of the weighted lever to shut the gate, at the same time moving the bolt outward to engage the keeper on the latch post. The weight on the free end of the weighted lever is adjustably held in desired place by a set screw, and in operation either rope is pulled only sufficiently, in opening or closing the gate, to swing the lever past its vertical position, the weight of the lever then causing the completion of the inward and outward movement of the gate.

WILLIAMS' ROAD GATE.

© 1893 SCIENTIFIC AMERICAN, INC

A NUBIAN KNIFE.

One of the most interesting sights in the Midway Plaisance of the World's Columbian Exposition at Chicago is the Cairo street, which is situated near the Ferris wheel. The street is very popular, and, as the admission is only ten cents, it enjoys rather more patronage than its neighbors which charge twenty-five cents. The street is extremely picturesque, the houses being tall and the windows having carved wood screens in front. A lofty minaret towers above them all. The brick-paved street teems with life and Copts, Cairenes, Nubians and Soudanese jostle each other in their anxiety to let their donkeys and camels. Egyptian women with their faces partly covered enact the part of flower maidens and attempt to dispose of faded pinks at fabulous prices. Under the houses are open shops in which are disposed a variety of Oriental articles which appear to meet with a ready sale. In one of these little shops the Nubian knife which we illustrate herewith was purchased.



THE COLUMBIAN EXPOSITION—A NUBIAN KNIFE.

The knife is made of steel and is nineteen inches long, and the points of the two upper blades are six inches apart. It will be noticed by reference to the cut that, whichever side or part of the knife were used, a serious wound would result. The axes of the blades are not parallel, and it would be interesting to know if there is any reason for this. The knife in the condition as sold is fairly sharp and bears fine file marks. The ornament might be described as simple barbaric dog tooth decoration. The handle is covered with leather and a twisted leather cord is provided to encircle the wrist. It is very doubtful if this weapon would prove as serviceable for actual use as a sword or dagger, but in the hands of a native skilled in its use it would probably prove very effective.

INTAGLIO EFFIGIES OF WISCONSIN.

BY T. H. LEWIS.

Besides the uncounted hundreds of mounds of earth, shaped to represent animals and other figures, which were constructed in prehistoric times in the southern part of Wisconsin, a few—very few—imitations were framed on the opposite principle. That is to say, that instead of earth being heaped up on the surface of the ground two or three feet in height, with a base shaped to resemble in outline some object of nature or art, the figure was formed by excavating a certain amount of earth, from within such a boundary line, a part of the dug-out earth being deposited around the margin of the excavation, in order to even up the irregularities of the natural surface.

INTAGLIO EFFIGY NEAR FOREST HOME CEMETERY.

The valuable explorations and surveys of the antiquities of Wisconsin made by I. A. Lapham in 1850 and 1851, which gave him the means of delineating hundreds of raised effigies, only brought to light in all some nine of the reversed kind, which for distinction may well be called *intaglio* effigies. These were all situated within 50 miles of Lake Michigan, in five localities, specified as follows:

No. 1.—A few rods east of the (old) Forest Home cemetery, about two and a half miles southwest of the mouth of the Milwaukee River, was a "lizard"-shaped excavation, at least 145 feet long, judging from his diagram.

No. 2.—On the west side of the Milwaukee River, six miles north of the center of the city, on "Indian Prairie," were four "lizard" excavations together. The largest of these was apparently some 290 feet in length; and there was another excavation a few hundred feet away nearly fifty feet long, and in shape as much like an outstretched hide as anything else.

No. 3.—On the school section, about a mile and a half southeast from the village of Pewaukee, was a "lizard" excavation about 133 feet long.

No. 4.—At Theresa, forty-three miles northwest from Milwaukee, were some curved embankments surrounding three separated ovoid or curlecue excavations that were in size from 20 to 28 feet long.

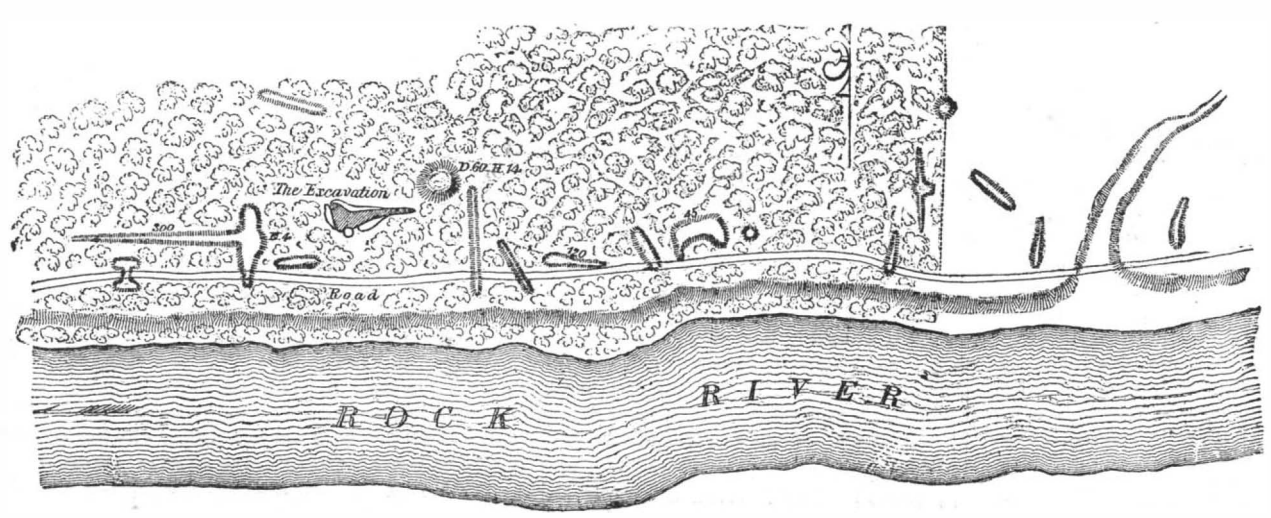
No. 5.—A little southwest of Fort Atkinson, and distant forty-eight miles west-southwest from Milwaukee, was a lizard excavation 130 feet long.

Now these are all the intaglios certainly known to have existed in Wisconsin, and with probably the exception of one locality, they no longer exist. But among them, one specimen at least is yet in good condition and fit to survey.

One day last month, during an archæological examination of the region where the intaglio referred to is situated, a careful survey of it was made, together with what remains of the mounds in the group of which it forms a part. This is the group at the locality referred to above as No. 5, near Fort Atkinson, Jefferson County. The length of this intaglio is 131 feet, and that portion of it which represents the body is two and a half feet in depth. A small portion of the earth taken from the excavation was distributed along the margin to make the immediate surrounding surface more even and symmetrical.

It may here be appropriately remarked that the term "lizard" applied by Mr. Lapham to those effigies which present head, legs, body, and an extraordinary long tail, shown in profile, should now be abandoned, for, since his time, it has been fully shown that saurians when imitated in earth are invariably in plan, as if looked down upon, never from a side view. The builders of the effigy mounds had most decided conventional methods of delineation, and this way of distinguishing reptiles from other animals was one of them.

It would be an interesting question to know whether the *intaglios* were built subsequently to the *relievos* or *vice versa*, but there seems to be no criterion at present by which the riddle can be guessed. If, however, at some future time, an intaglio should be discovered across which a leg, tail or wing of a relievo should be carried, thus filling part of its hollow; or, on the other hand, one whose excavation is continuous through any part of a raised mound, the relative priority would then be unmistakably obvious—at least as regard the specimens found.—*The American Antiquarian.*



GROUP OF EFFIGIES NEAR FORT ATKINSON WISCONSIN.

The Economy of Gas or Electricity for Illumination.

Dr. R. A. Witthaus, who conducts the chemical department of *The Engineering Magazine*, writes: It is curious to note the controversies regarding the relative value of the electric light and of manufactured gas for illuminating purposes which appear in each issue of the journals devoted to these respective industries. But while such controversy is necessarily futile in itself, undoubtedly it is productive of good results on both sides, resulting in the study of shortcomings and, where possible, in the remedy of the same. In Indianapolis the other day the current from a trolley wire went wandering and descended the hollow iron supporting pole until it made contact with a "dead" gas main. After burning a hole in this, it continued on along the dead main until it reached a point where this crossed a main carrying gas, and here burned a second hole. The gas now escaped through into the dead main, and finally, passing up the pole, was set on fire, the wires were burned and traffic stopped. On the one hand, of course, this is proof that such a dangerous commodity as gas should not be allowed on the main thoroughfares, while on the other hand it clearly shows that the pressure of a powerful current of the electric fluid is a constant menace to human life. We do not intend to argue whether it was the match or the gunpowder which did the damage, but merely to speak of the relations of these too frequent accidents to chemistry, over that bridge between chemistry and electricity, namely, electrolysis.

A CURIOUS TREE GROWTH.

To the Editor of the Scientific American:

The beautiful picture which appears in the issue of May 13 of the SCIENTIFIC AMERICAN, showing a remarkable tree growth at Saratoga, leads me to send you a photograph of one of these "freaks," which seems quite as curious.

A CURIOUS TREE GROWTH.

The trees are in a piece of wild woods on the side of Mount Meenahga, near Ellenville, N. Y. They are beech trees. The one at the left makes nearly a right angle at about seven feet from the ground, and at a distance of three feet enters the side of the other and larger tree. The bark is perfectly smooth all around, and the junction resembles the springing of a natural branch. There are other oddly contorted trees near, one of which appears in the photograph.

Another pair is composed of a hemlock and an oak, perfectly joined at the height of about ten feet.

E. E. S.

The Largest Cave.

Under the dome of the Horticultural building at the Chicago Exposition there is an exhibit that will direct the steps of many tourists to North Dakota. There are several underground rooms decorated with stalactites and stalagmites taken from the great cave discovered in the Black Hills region. This cave is 52 miles long, and nearly 1,500 rooms, some of them 200 feet high, have been opened. There are streams, waterfalls, and 37 lakes, one of which is an acre in extent. The cave is 6,000 feet above sea level and 400 feet below the earth's surface. Petrified bones, snakes, and wood are taken from it. The theory is that these pieces of wood were washed in through the opening. A piece of pitch pine was placed in the water three years ago, and now it is shown in a petrified state.

The *Northern Lumberman* suggests the exhibit is an advertisement which will attract many to visit the natural cave.

© 1893 SCIENTIFIC AMERICAN, INC

NEW YORK HARBOR IMPROVEMENT MODELS AT THE COLUMBIAN EXPOSITION.

Visitors entering the United States government building from the western entrance facing the lagoon, will find the exhibit of the Corps of Engineers of the War Department, consisting of representations of the work done at the mouth of the Mississippi River; of the harbor at Key West, Fla.; Iron Pier at Lewes, Del.; Delaware Breakwater, and models showing the improvement of New York Harbor.

These latter delineate as a whole an engineering achievement of the first rank, and are as perfect specimens of technical work as can be found.

These models have been constructed under supervision of Lieut.-Col. George L. Gillespie, who is in charge of the work they represent, and to whom and his assistants, Mr. J. Paul Mayer, Mr. Harrington, and others, we are indebted for the opportunity of inspection and also for information concerning the same.

The approach to New York City at the entrance of New York Harbor, near Sandy Hook, is controlled by a narrow neck of shifting sand that is continually yielding its substance to the waves of the Atlantic that break upon its exposed shore. To preserve this shore from sea erosion a heavy riprap wall with groins extending from high to low water mark has been built. This, with the various buildings, roads, varying surface of the land and depth of water is shown with minutest fidelity. In our engraving, No. 1 shows location of the bell tower, 2 the Hook beacon, 3 Maritime Exchange signal tower, 4 telegraph station. The model showing Hell Gate (the narrow passage to New York City from Long Island Sound) before improvement gives an accurate idea of that once-dreaded stretch of water, and we can easily imagine the feelings of the early navigators as they were whirled through on the boiling water between rocks that threatened to destroy them on every hand. Before the advent of the first Sound steamer (built by Fulton), trade was carried on by swift sailing packets that left New York so as to pass through Hell Gate with the last of the flood tide. After the successful voyage of the first steamer a regular time for departure was established and it was triumphantly announced that Hell Gate had been robbed of its terrors by steam.

In order to compete with steam the sailing vessels had to risk the passage regularly, and consequently more lives and property were lost after the application of steam than before in running the gauntlet of these obstructions.

In referring to the engraving, No. 1 represents the northern end of Blackwell's Island; 2, Bread and Cheese; 3, Flood Rock; 4, Gridiron and Hen and Chickens; 5, Negro Heads; 6, Little, and 7, Great Mill Rocks; 8, Heel Tap; 9, Rhinelander's Reef; 10, Hallett's Point; 11, Frying Pan; 12, Hog's Back; 13, Holmes' Rock; 14, Pot Rock; 15, Way's Reef; 16, Mussel Shell.

The great increase of traffic after steam was applied to the navigation of Long Island Sound in 1817 called for recognition of its rights to a diminution of the dangers of this waterway, and in 1848 Lieutenants Davis and Porter recommended to Congress the destruction and removal of Pot Rock and Way's Reef, and in 1852 Major Fraser, using Mailiefert's system of submarine surface blasting, began operations.

In 1867 General Newton examined Hell Gate and recommended for the removal of isolated reefs the construction of a cupola scow. This was built the next year and had a well hole 32 feet in diameter and was provided with 21 drills.

It was used on Diamond Reef in 1869, Coenties Reef in 1871, and the Frying Pan in 1872.

The East River makes a right angle at Hallett's Point, Astoria, and another at Negro Point, Ward's Island, and work was begun in August, 1869, to remove the reef at the former point.

A detailed survey made in 1871 of the surface of the reef consisted of the location of 10,000 soundings. By this means the engineers were enabled to regulate the length and height of the headings that radiated from a shaft protected at the top by a cofferdam.

These operations were continued until September 24, 1876, when 52,000 lb. of explosives rent the pillars and roof of the mine.

The rock thus broken up was removed by dredges, and vessels could thus pass 150 feet nearer the shore. The greatest engineering work, involving the destruction of Flood Rock and the minor reefs connected with it, was completed October 10, 1885.

On that day 150 tons of dynamite and rackarock lifted into the air a column of water 1,200 feet long, 700 feet wide, and 200 feet high. A model of part of Flood Rock is shown in our illustration.

It is so constructed that the roof can be raised so as to show the galleries and headings and system of exploding the mine.

This roof in the original of the model was of an average thickness of 15 feet and an area of about 9 acres. It was supported by 476 columns, and the depth of the shaft was 64 feet.

The mine at Hallett's Point was exploded by a system of quick-burning fuses; every cartridge being connected in a series, which was in turn connected with another. In Flood Rock, however, the greater number of cartridges were inserted in the holes, which were then plugged up.

Beams were placed across the main passages from corner to corner of the pillars and connected; and the explosion of these caused that of those embedded in the walls by sympathy.

For eight years dredges have been at work removing the debris caused by this explosion and a depth of 22 feet of water has now been reached. When there is an even channel of 26 feet, the work of dredging will be discontinued. The work of demolition was so thoroughly done by the explosion of 1885 that only occasional blasting is now necessary in order to forward the work of clearing the channel. One of the models shows the appearance of the rock, above the surface before the work was commenced.

There is now a depth of water of 26 feet over all the other obstructions except the Bread and Cheese, which is now inclosed by a sea wall, Hog's Back and Holmes' Rock and Great and Little Mill rocks, which are united by a causeway.

Another extensive work shown by the models is the Harlem River improvement, which consists of the deepening of the channel of Spuyten Duyvil Creek and the Harlem River and the removal of the rocky divide which separates them just below the village of Kingsbridge. This model is remarkable for the completeness and fine execution of details, the tracks of the railroads, drawbridges, signal stations, etc. The depth of the creek and of the cut are presented with exactness, and that part which shows the rock removed from the cut can be lifted out.

These models are carved in wood from the plottings taken by the engineers, and reduced to the different horizontal and vertical scales, each point being verified by reference.

A gelatine mould is then made from which plaster casts are taken, and the parts colored in accordance with the rules of engineering technique.

Where Tin Comes From.

The United States consul at Singapore says that more than one-half the world's tin is mined in the Straits Settlements. The output for the year 1891 was 57,551 tons, against 36,061 tons for the Straits Settlements. If to this 36,061 be added the 12,106 tons, the output of the Netherlands India, whose tin-bearing islands are within a few hours' steam of Singapore, it will leave but 9,384 tons for the rest of the world. Up to the introduction of modern tin mining and smelting machinery in 1889, the tin was worked for a century in a most primitive fashion by the Malays. They simply dug down at the base of a hill, took up the clay which contained the *biji timah* (small nodules), and carefully washed it in running water. When dry, it was smelted in a furnace built of clay between two layers of charcoal, the fire being forced into a glow by means of bamboo bellows. When the metal became molten, it trickled through a hole in the bottom of the furnace into a vessel, from which it was ladled into moulds, forming slabs weighing about 2 catties (2⅔ pounds). A rajah's or chief's wealth was reckoned in bars or slabs of tin. The primitive tin mining of the Malays gave place to the more energetic and thrifty mining of the Chinese, who brought with them better tools and better business methods. The Chinese monopolized the entire field, until the formation of the Jelebu Company, in 1889, with which the Chinaman can still compete.

The Chinaman's manner of working is simple, though thorough. As the float tin lies at a distance of from twenty to fifty feet from the surface, gradually diminishing toward the hill sides, where it is not more than six feet, the jungle is cleared along its source, and water is brought by a ditch from the nearest stream. At about six feet down, the water begins to rise from the soil, and to get rid of this, and also to utilize the water from the stream as a motive power, an ingenious chain pump is made by constructing a long wooden trough of three planks, each 100 feet in length, and this is placed with one end resting on the bank, the other sloping to the water in the lowest part of the mine. A wooden chain, with its small oblong pieces of wood placed at right angles to the line, is fitted accurately into the trough. The wooden chain is endless, and is passed round two wheels, a small one at the lower end of the trough and a large one at the upper end. The latter is a water wheel, and is turned by a constant stream of flowing water. Round the axle of this wheel are cogs, each of which, in turn, as the wheel revolves, draws up a link of the endless chain through the trough, and, as each joint fits accurately into the trough, they bring up in succession a quantity of water, which on reaching the mouth of the trough falls into the channel by which the water which turns the wheel is carried off, and is thus also taken away out of the mine and conducted to the next, when the process is repeated. The small wheel at the lower end of the trough regulates the chain and guides the wooden joints into the trough.

The Chinaman's tools consist of a hoe, two baskets, and a bamboo pole. The soil is scraped with the hoe into the baskets, which in turn are balanced over his shoulders at the ends of the bamboo pole. The washing is performed in much the same way as placer gold is washed in California and the West. The soil is thrown into a trough filled with running water, in which the dust is carried off in solution, and the ore retained by means of wooden bars nailed across the bottom of the trough. While the Chinese system of smelting is similar to that of the Malays, it is more elaborate, and carried out on a much larger scale. In place of the bamboo bellows, a very ingenious plan is adopted. The trunk of a tree, about 18 inches in diameter and 10 feet long, is carefully hollowed out and closed at either end. A long pole, with a circular piece of wood at one end, fitting exactly into the bore of the tube, acts as a piston. In order to secure the tube being perfectly air-tight, the end of the piston is well padded. Valves are placed at each end, to allow the air to enter, and the center of the nozzle of the bellows communicates with the furnace by means of a small air passage. On the piston being drawn out, the air in the higher portion of the tube is forced down the nozzle, and being drawn back, the air in the further part of the tube is similarly drawn into the furnace. The charcoal is soon brought to a white heat, and ready for the moulds. The best of the Chinese mines are found in Laroot, in the northern part of Perak, south of the Siamese State of Quebrada, in a stratum of whitish clay. In some of the tin mines in the neighborhood of the Batang and Padang rivers, small quantities of gold are found mixed with tin.

Consul Wildman says that the Jelebu Tin Mining and Trading Company is the only successful European-managed mining adventure in Malaya, and one of the chief producers of Straits tin.

Fall of an Aerolite.

The Spokane *Review* (Washington) of June 2 contains an interesting letter from Engineer's Camp, on Beaver Creek, B. C., which states that on May 26 last a mereoric stone, or aerolite, exploded in that vicinity, the fragments falling along Beaver Creek, about ten miles above its junction with the Columbia River. At about 4 P. M. on that day there occurred fifteen or twenty short, sharp reports following each other in quick succession. The first report was the loudest, but all were clear and distinct. The noise was heard at Sayward, Waneta, and even at Northport, nearly twenty-five miles away. A party of engineers surveying on the Nelson & Fort Sheppard railway were working in the vicinity. At first they thought the noise was thunder or a railroad blast, but there was no blasting being done within six or seven miles. Following the reports a whizzing sound was heard as if made by some body moving swiftly through the air. They were working in thick, heavy timber, and therefore could see nothing, and no fragments fell close enough to be heard strike the ground. At the time of the explosion a man named J. W. Gerling was walking along the trail up Beaver Creek. He heard it, but at first supposed it to be thunder. A few moments later he heard the whizzing sound above mentioned, and as he looked up to see whence it came, it grew louder and louder, until a stone struck the ground not far from where he was standing. He searched for it a few minutes, but the bushes were so thick he could not find it, and the fragment evidently was small. Ed McLeod, who is building the "tote" road for Contractors Peter Larson & Co., says that the report seemed to come out of the sky almost directly above the place where he was working. A fragment fell within fifty feet of him, and although it buried itself in the earth, he succeeded in finding and digging it out. The specimen would weigh four or five pounds. One or two other fragments were observed to fall and two laborers were very nearly struck by one piece. On the following day Mr. James Hislop, of the engineer corps, was taking topography near where Ed McLeod found his specimen, and while so doing came upon a hole in the earth about the size of a badger hole, and evidently freshly made, as loose earth had fallen back in it. The hole was at about an angle of sixty or seventy degrees. Together with Mr. E. L. McNair and Otto Austin, also of the engineer corps, they made an excavation and at a depth of about three feet came upon a rock weighing about twenty-five pounds, which was exactly similar to the piece found by Ed McLeod. It was taken to camp and is now in Mr. Hislop's possession, who values it highly. Other fragments, and probably larger ones. fell, but as they scattered three or four miles apart, and the country is mountainous and thickly timbered, there is little chance that any more will be found.

Naphthalene as a Timber Preservative.

Naphthalene, which is a product of coal tar distillation, in appearance something like paraffin, has been found useful in England for the preservation of timber. The wood is soaked for two to twelve hours in the melted naphthalene at a temperature of about 200 degrees Fahrenheit.

© 1893 SCIENTIFIC AMERICAN, INC

Composition Paint.

This refers to a composition paint which will not corrode when subjected to the action of water and further renders the material coated waterproof. The paint consists of:

Spirits of wine	1	gallon.
Shellac	4	pounds.
Resin	1	pound.
Steatite	½	pound.
Lampblack	2	pounds.

Instead of lampblack, any other desirable pigment may be employed. The ingredients are thoroughly mixed together, and for 30 minutes subjected to a heat of 212° Fah., and then allowed to stand for 48 hours. The mass is subsequently strained and ground in an ordinary paint mill.

The Pennsylvania Company's New Station at Philadelphia.

At this station, an engineering work of considerable interest is now being carried out by Mr. Percival Roberts, of the Pencoyd Iron Works. At present the station platforms are covered by two arched roofs of moderate spans, but a short time ago the company decided that the width of the station should be increased and placed under one roof, the width of which will be 307 feet clear, a dimension exceeded only by two other famous structures—the Machinery hall in Paris and the Manufactures building at Chicago. It was a matter of necessity that this alteration should be carried out without interfering with the constant traffic of the station, and accordingly the great span is being erected over, and clear of, the existing roofs, which will be removed after the completion of the new structure. In design the new roof will resemble very closely that of the Jersey City station. Large areas of glass in exposed situations, and at a great height above the ground, are a constant source of expense for maintenance, and what is much more serious, a standing danger to the people on the platform beneath. These dangers have been practically obviated by the use of glass moulded upon round steel wire netting. The netting is embedded in the glass, so that fracture becomes practically impossible, and in any case must be limited to very small areas, and no broken glass can fall to the ground. This new glazing material can be bent, and in this way curved skylights can readily be made. The method of making this wire-strengthened glass was illustrated in the SCIENTIFIC AMERICAN of Nov. 5, 1892.

JAPANESE AT THE WORLD'S COLUMBIAN EXPOSITION.

One of the most picturesque parts of the Exposition on opening day, says *L'Illustration*, was the Japanese section, before which the exhibitors had grouped themselves, offering a picture that was truly characteristic of this race, which is gradually becoming Europeanized. Some have adopted modern garments, while others, who are more timid, retain a part of their national costume, but wear shoes instead of slippers, and have English caps on their heads.

REFRACTION AND DISPERSION OF LIGHT.*

Fill an ordinary drinking glass, having a plane bottom, one-third full of water and incline it, as shown in the engraving, so that the water forms a prism. This permits the observation of the phenomena of refrac-

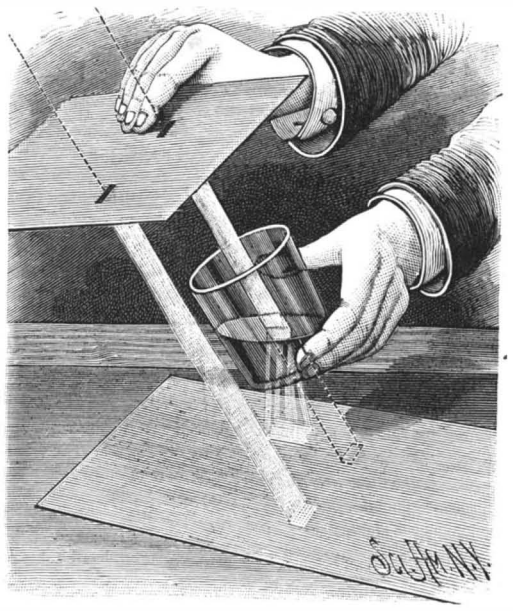


Fig. 1.—REFRACTION AND DISPERSION.

tion and dispersion of light. The experiment may be performed in the sunlight or by means of a lamp in a darkened room. In the first case, a card, having two slits made in the same line, is held over the glass and the glass is inclined so that the rays of the sun pass through it parallel to its axis. The card is held parallel with the top of the glass containing the water. Through one slit the light is allowed to fall on the

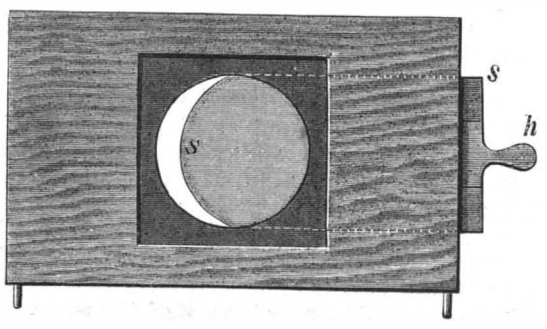


Fig. 2.—SLIDE ILLUSTRATING IRRADIATION.

water in the glass, and through the other upon a piece of white paper placed under the glass. The beam is seen diverted from its course, and upon the paper is seen the spectrum.

The pencil of rays emerging from the glass is thus seen diverted from the path of the incident beam and also dispersed.

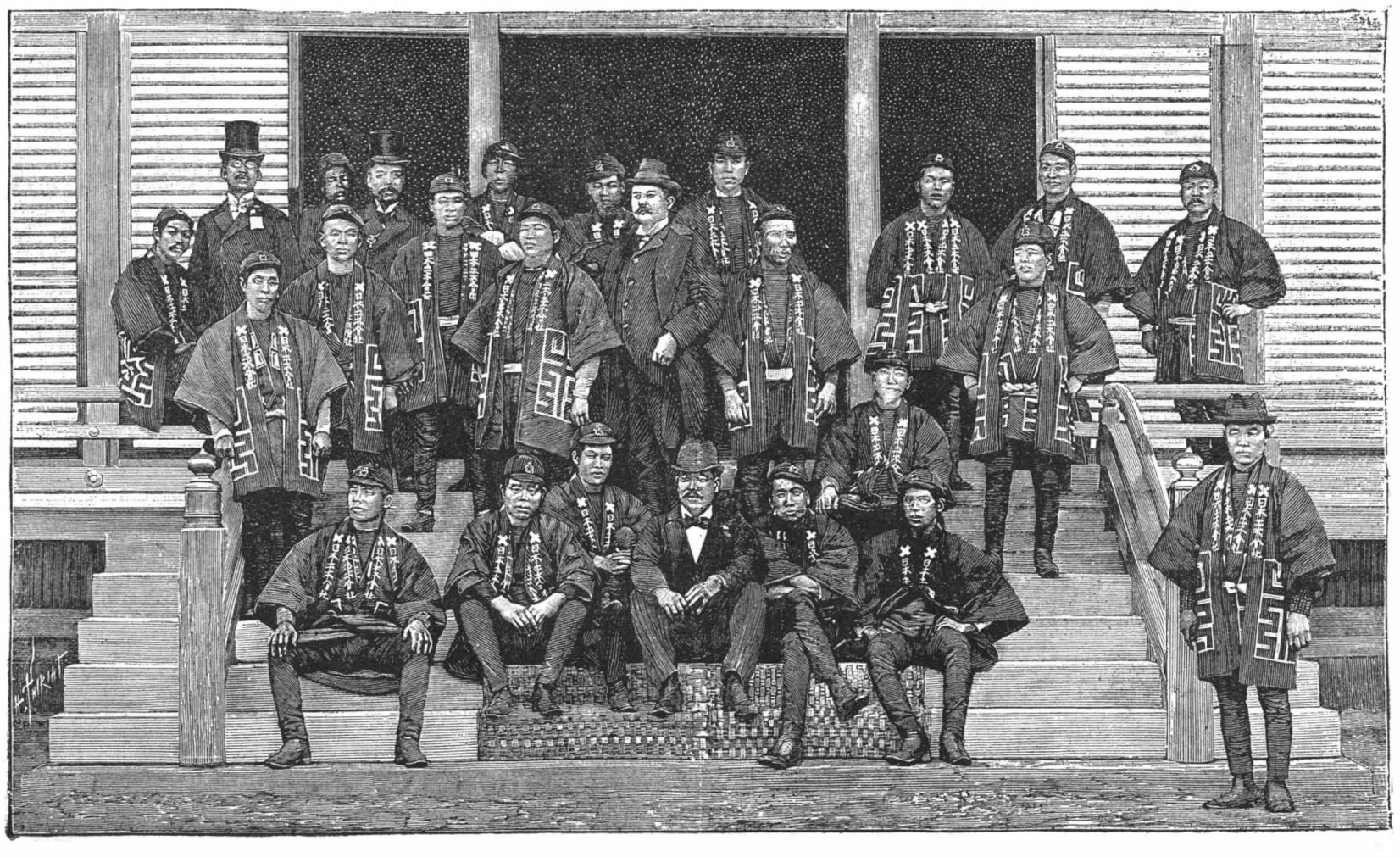
Irradiation.—This phenomenon, which is frequently noticed in observing the new moon, may be demonstrated experimentally by the apparatus shown in Fig. 2. The frame, which is fitted to an optical lantern, carries an opaque plate having a circular opening, before which a slide, *s*, of ground glass or paper, is placed. If this slide is opened only a little way, the outer border of the half crescent appears to be formed on a larger circle than that of the dark part.

Engraving Glass by Electricity.—The glass plate to be engraved is covered over with a concentrated solution of saltpeter and connected with one pole of a battery. A fine platinum point is connected with the other pole. This point serves as a drawing pencil, and the lines traced by it will be found etched in the surface of the glass.

* From the German translation of "Experimental Science."

Photography as an Aid to Art.

At the meeting for the distribution of prizes to the students of the Art Training School, South Kensington, an address was delivered by Mr. W. F. Yeames, R.A. He pointed out that the standard of work required from artists was getting higher every day, the competition, owing to the increase of their number, being also very much greater. Students must always bear in mind that the instruction received in schools was always technical only, and that they were but on the threshold of art when they left the school, and must depend for success upon their individuality. When they entered into their work in the field of art they would come under many influences, and it was on one of these he wished to dwell, that of photography. Photography had done a great deal, especially for art. In one branch it had been an enormous help in the reproduction of the works of fine art throughout the world. Photography was a feature of the age of science and mechanical appliances, and, like all things scientific, dealt in facts. In no photograph did one see any expression of the emotions of the heart; but these were qualities which they, as artists, would have to deal with. In a broad way he would say the art of drawing had improved under the influence of photography, but he would make a slight exception as regards the rendering of human form and face by the great masters. He could not say that photography had excelled the productions of these great men, who had such a keen perception of everything in nature that they were able to produce results that photography had never surpassed. But with nature in general, vegetable life, clouds, etc., photography had brought to light many things not known before. With reference to when and how students should use photography, he said the artist could use it with impunity when his knowledge enabled him to do without its services: that is, a man should be master of photography, and not photography master of the man. Before using it he should be so well grounded in the technique of drawing as to be able to draw any object in nature; photography would then be of much use to him, as it would lighten his labor and extend the range of his subjects. Photography should be used only as an aid to art work.



JAPANESE AT THE WORLD'S COLUMBIAN EXPOSITION.

© 1893 SCIENTIFIC AMERICAN, INC

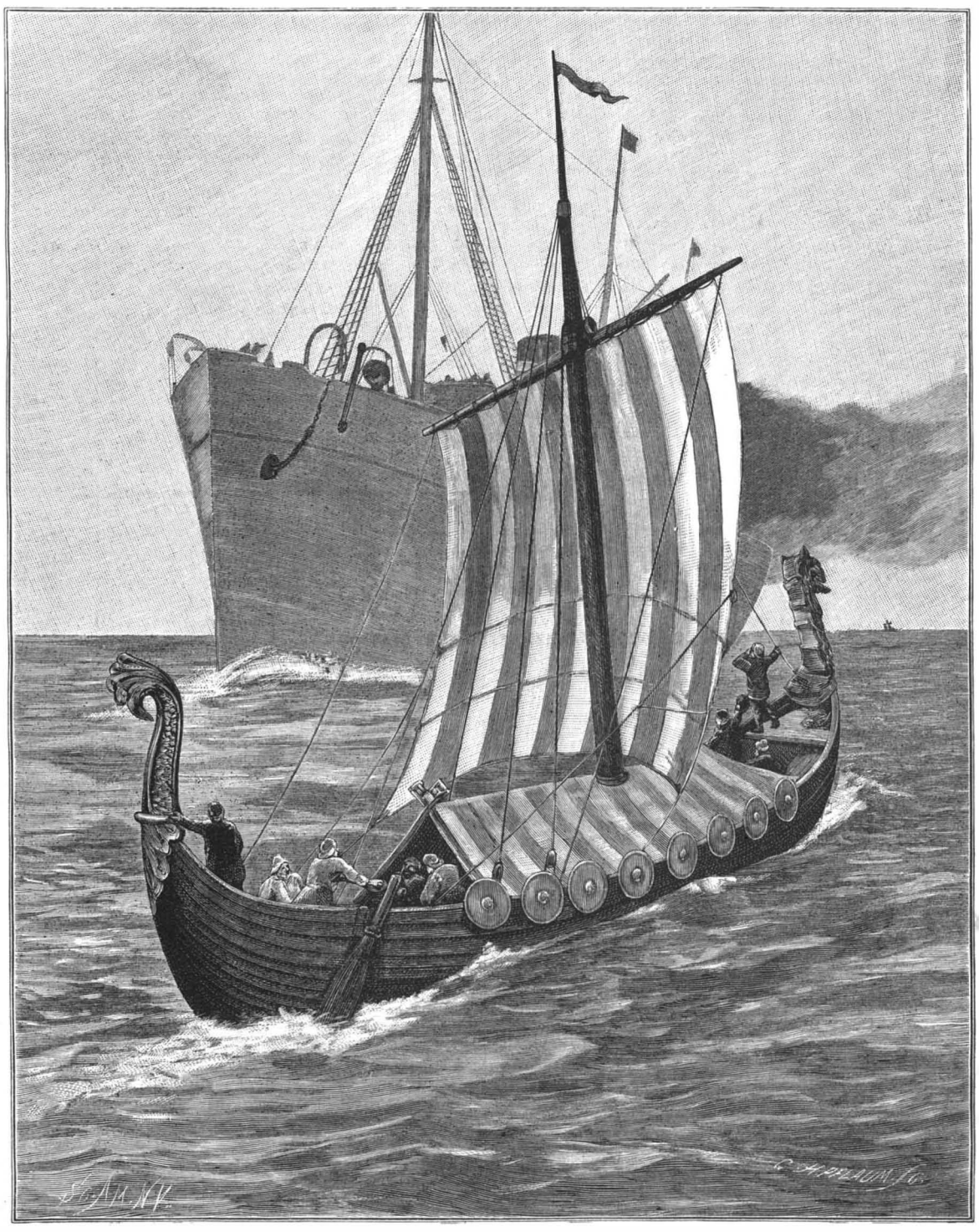
THE VIKING SHIP FOR THE COLUMBIAN EXPOSITION.

The Viking ship, a reproduction of the famous Gokstad find, has reached our shores, after a successful voyage. The trip goes to show how the ocean may have been successfully traversed by such a craft under sail power, and is a corroboration of the possibility of the discovery of America by Leif Erikson. Our cut shows the general appearance of the little craft as she might be seen in midocean speaking a great liner. Seventy-eight feet long, sixteen feet wide, and drawing but four feet of water, she is but a little larger than the long boat for a modern five hundred foot leviathan. In the background of the picture, the bow of a modern ship is seen towering far above the picturesque little cockle shell that, unassisted, has made her way across the Atlantic Ocean.

On April 30 the Viking ship left Bergen, Norway. At 3 o'clock on the morning of May 27 the east coast of Newfoundland was sighted. On May 29 Cape Race was passed. On June 13, at 4 P. M., the port of New London was made, the first American harbor the ship entered. The voyage was highly successful, and went to prove the excellence of the ship's model.

In one severe gale, the ship lay to for eight hours, with a drag or sea anchor out. She rode well, but shipped a little water forward. A second gale was encountered, in which, under close-reefed foresail, the ship successfully scudded before the wind.

The ship and her master and crew have been made the objects of well merited ovation, and her progress to Chicago will be a march of triumph in every sense. The Gokstad ship from which she was built is fully described and illustrated in our SUPPLEMENT, Nos. 241 and 251.



THE WORLD'S COLUMBIAN EXPOSITION—THE VIKING SHIP RECENTLY ARRIVED FROM NORWAY.

The Blistering of Paint.

Unless caused accidentally by the action of heat, or naturally by the sun's rays, helped along by pitch or oil in the wood, we may conclude that the blistering of paint is due to the presence of moisture in the wood which was either there when the paint was put on or has got there since by leaks, letting the water into the back of the wood, soaking it, and so forcing the paint to let go its hold.

In house painting, much of this occurs from too much haste in painting unseasoned spruce clapboards; or in painting them in the early morning after a very heavy dew has fallen on a hot summer's evening and before the sun has had time to dry them off. The grass about the building is wet; you could not walk through it scarcely without wetting your feet; and why should not, with some movement of the atmosphere, the sides of your newly clapboarded building be wet also? They are; and though barely perceptible to the feeling of the palm of your hand, nevertheless, those clapboards, like a sponge, have absorbed a considerable amount of moisture, which can but have a deleterious effect upon your paint that you have put on before it has had time to dry out. New spruce clapboards should also stand a fortnight or so after being put on, exposed to sunshine and storm so as to get well "tanned up" by the weather, and the grain opened so as to admit well the penetrating qualities of the paint; and, if dry when painted, your paint will stay there, if good for anything and decently applied. Of course, it is understood that time enough must be given after a storm to have the work thoroughly dry before paint is put on, and this is usually done; but the other conditions above named are not always observed, and as a consequence, somebody's paint is condemned when it is not to be blamed, but the one who used it is the guilty party. I know of three double tenement two and one-half story new houses that were painted in this city recently, two of them with a well-known and popular brand of ready-mixed paint and the other with lead and oil, all of which blistered more or less, and the ready-mixed paint agent had to stand the cost of repainting his two houses because he guaranteed the paint not to peel, though it was no worse than the other one painted with lead and oil, and the contractor acknowledged the paint could not be at fault. Doubtless the trouble lay in one of the causes I have named and too much haste to get the paint on. When will the avaricious painter ever learn that "haste makes waste," and take time to do work as it ought to be done?

Then, again, a poor brushman is the cause of leakage in nail holes and around joints; he does not fill all these places with paint as he goes along, so as to exclude the water that is sure to soak in later on. Here you may observe the difference between a good and a poor workman; the former wipes his brush into all cracks, crevices, holes, and cross grained places in his work as he goes along, not only making it look much better, but rendering it impervious to moisture, while all the poor hand seems to think necessary is to smutch over the work so as to give it the appearance of having been done over with the same color! Thoroughness and appearances are vastly different matters.

Finally, if the painter's attention has been called to some of his work which has blistered, let him prick the blisters, and if water runs out of them, he may rest assured that there is a leak somewhere, letting the water in on the back of his work; and it is only a question of searching until he finds it. It may be a leaky roof, which only much painstaking will locate the spot in. Underneath the projecting "visors" over the platforms of passenger cars I have known much of this trouble to be caused by a leak in a tin roof which has rusted through in a small spot hardly perceptible, by cinders soaked with water lying along beside the water cans. The painter will be blamed until he takes the trouble to get a ladder and begin the inquest. The new steam heat from the locomotive, lately adopted on most roads, when discharged under the cars at terminal points, will cause paint to blister and peel from those panels on each side of the car about midway and opposite the let-off valves; not because the steam is hot enough to do this, but because of the moisture from the vapor that is continually arising and soaking into the ends of the panels and behind and around them. In fact, I have seen cars completely enveloped in the clouds of steam which were discharged from the train while standing still, which ought not to be done, but rather should be let off before the terminus is reached, while the train is in rapid motion.

No matter how righteous a paint may be, or however well put on, if the wood gets water-logged, it will blister and let go. Good paint and water have no affinity for each other; water is the third party which will cause a separation between paint and wood, however well married they have been.—*By Charles E. Copp, in the Painters' Magazine.*

Testing 100 Pound Rails.

The New York, New Haven & Hartford Railroad has ordered from the Maryland Steel Co. 15,000 tons of 100 pound rails for use during this year. The chemical composition of these rails is left to the judgment of the makers, except that it is to be made of as high carbon as they are willing to make and still meet the requirements of Section 8 of the specifications, which reads as follows: While the heat is being cast two ingots shall be made. The first from steel going into the first regular ingot, the other representing the last one. These test ingots shall be 3 × 3 inches and not less than 4 inches long. From them bars at least ½ inch square shall be drawn at one heat. Each bar when cold shall be bent without breaking by the blows of a sledge to not less than a right angle. Should one bar from a heat fail and the other stand the test, a third bar may be taken from a bloom rolled from the same ingot represented by the failed one. If this stand the test, it shall be accepted in lieu of the failed bar. If the maker choose, more than two test ingots may be taken, but they must be from the steel of the first and last regular ingots. If this is done, and a test bar fail, another may be drawn from the duplicate ingot and tested, and if it stands accepted. A rail butt from each conversion shall be placed either head or base upward on solid steel or iron supports, the distance apart of which in the clear shall be 4 feet, and upon them shall be dropped a weight of 2,000 pounds falling freely from a height of 16 feet for under 100 pound and 20 feet for 100 pound rail. Should a test fail to stand the drop without breaking, a second one may be made. If it also fails, all rails made from that heat shall be rejected, but if the second test stands, then a third shall be made. If this is successful, the rails of that conversion shall be accepted.—*American Manufacturer.*

A Fever Annunciator.

The *Lancet's* Paris correspondent tells of an apparatus of recent invention for registering rises of temperature from friction in a machine, from fermentation in a mass of grain, etc. A small metallic bulb half filled with ether is sealed by a corrugated cover. When the temperature rises so as to expand the ether vapor sufficiently, the cover is straightened out by the pressure and made to close an electric circuit that works a bell. It is said that the inventor, M. Tavernier, cherishes the project of fitting up hospital wards with these bulbs, each of which, secured in a patient's axilla, shall operate a numbered bell in the interne's room, after the manner of hotel annunciators. By this means it is expected a sudden and dangerous rise of temperature in any particular case may at once be brought to the interne's notice.

© 1893 SCIENTIFIC AMERICAN, INC

RECENTLY PATENTED INVENTIONS.

Engineering.

LOCOMOTIVE DRIVING GEAR.—David S. Patterson, North Platte, Neb. This invention provides for a front and a rear cylinder arranged on opposite sides of the driving wheel and connected by their pitmen with crank pins on opposite sides of the center of the driving wheel, the improvement forming a driving gear of simple and durable construction, designed to prevent horizontal straining of the axle journals and pounding of the wheels on the rails, whether caused by the centrifugal force of a single main connecting rod, a single parallel rod, or a single crank pin, or by the angular thrust of the main connecting rod.

ENGINE GREASE ARRESTER. — Jeremiah F. Traver, Newburg, N. Y. The oil, grease, and other impurities with which the steam becomes charged in passing through the engine to the condenser are effectively separated from the water of condensation, according to this improvement, in a novel form of filter box, the water of condensation being returned to the boiler comparatively pure. A pipe valve is adapted to be seated on the outlet pipe of the filter box, the valve being actuated by a float and extending from its seat to a point above the highest level of the water in the filter box, whereby only the lower, pure strata of water can be drawn off by the pump, the impurities being held for removal when a sufficient quantity has accumulated.

Railway Appliances.

CAR COUPLING.—Joseph Zehneck, Magdeburg, Germany. This is a device especially adapted to the form of car coupling employed on the German state railways. Combined in the coupling is a drawhead having a hooked outer end, a rock shaft on which is a yoke pivotally connected with a link, with means for throwing the shaft, while a frame pivoted to rock vertically has an operating lever, the frame carrying arms diverging from each other and extending across the hooked end of the drawhead.

CAR COUPLING.—Lemuel S. Manning, Alessandro, Cal. In this device a cylindrical drawhead is employed, spring cushioned against percussion and draught strain, conically recessed at its front and provided with a pivoted latch block adapted to interlock with an elongated slotted link. The coupling link has a conical recess at its front end, the link body having nearly parallel side walls, with top and bottom walls tapered toward each end from the center of length, and similarly slotted near each end to receive the tongue of a latch block in the conically recessed drawhead. The device is adapted to couple automatically with another coupling of its class, and uncoupling may be readily effected from either side of the car.

METALLIC TIE.—Charles Worden, Rye, N. Y. The body of this tie is formed of a central arch and upwardly projecting side flanges, its shape being designed to insure great strength and at the same time permit of using comparatively thin sheet metal. Blocks resting upon the arch engage the flanges to prevent them from spreading, the blocks serving as supports upon which the rails rest. At or near the middle of the arch is a longitudinal opening through which packing material may be introduced to insure the stability of the tie on the track.

IMPROVED TRACK. — John Murnane, Coopersville, N. Y. To securely hold the rails so they cannot spread and prevent accidents from broken rails is the object of this invention. The rails are each provided with a casing made in two sections, formed in such a manner that each covers one half of the base of the rail, the web, and the under side of the base of the rail. The sections are held in place by bolts passing through at the web, where the sections are united together and secured to the rail. The rail so protected can be spiked to the ordinary wooden tie, but a sectional tie of special form and having curved flanges engaging the casing sections is preferably employed.

Electrical.

TIME SIGNAL. — Gerhard W. Van Vianen, Cologne, Germany. This invention relates to electric alarms for dwelling places, hotels, etc., permitting visitors, guests and others to set the alarms for any time in their own rooms, so that the occupants of rooms will not be dependent on the punctuality of servants or others. The apparatus is set in motion by a clock provided with specially constructed contact mechanism, there being placed in each room a plug contact apparatus provided with a bell which serves as an alarm, conducting wires connecting the clock with the different alarms.

WIRE COUPLING.—John Bodine, Pittsfield, Ill. To couple the ends of electric wires, or mend broken wires, so that the circuit will be as good as it was before the break, is provided for by this invention by means of a longitudinally bored coupling body, with two pivoted clamping dogs pivoted between their ends to the body and projecting at their inner ends into the bore, a spring-pressed plate bearing on the inner ends of both dogs. The ends of the wires are thus firmly bound in place in such way that the grip of the coupling is increased by increased tension on the wires.

TOWER WAGON. — Joseph S. Hill, Lafayette, Ind. This is a wagon to facilitate stringing trolley wires for electric railways and for putting up electric lines generally. It has an extensible tower and is provided with an insulating platform for supporting the wagon, there being also a reel for holding the line wire, sheaves for guiding it, and a brake controlling the reel, whereby any desired amount of tension may be given to the wire.

Mining.

MINER'S SAFETY LAMP. — Heinrich Hubner, Hermsdorf, Germany. This is a lamp in which the ignition of the wick is effected by the explosion of a percussion cap or the like, the invention also providing other novel features designed to insure safety, the construction being such that the chimney and the gauze cylinder may be readily connected and disconnected from the reservoir, while the accidental disconnection of the parts is guarded against.

COAL WEIGHING BASKET. — Simon Jones and Samuel B. Bishop, Hamilton, Ohio, and Thomas C. Dupont, Central City, Ky. This is a device for weighing coal in transit from the inclined screens or chutes to the railway car, the basket being of such construction as to permit the miner's quota of coal to be weighed at one operation, and yet separate this quantity while in the basket into different grades to be separately discharged into different cars or be loaded with the other coal which goes through the screen for which the miner is not paid.

Agricultural.

CULTIVATOR.—Joseph R. Finney, Randolph, Wis. The cultivation of corn and similar plants is especially the design of this machine, in which, when two rows of teeth are employed, either of the rows may be raised or lowered independently, or both elevated or depressed simultaneously, while the beams carrying the rows of teeth are so swiveled to the frame of the machine that when the latter is turned at the end of a row the cultivator does not injure the plants. The cultivator teeth are also of peculiar formation, and in their rear are located the teeth of hill coverers not adapted to enter the ground, but to travel quite close to it.

SEED POTATO CUTTER. — Isaac Dunn and William R. Dunn, Jr., New Brunswick, N. J. This is a device to facilitate the cutting of potatoes for seeding purposes without danger of bruising or injuring the eyes or skin of the potato. The box containing the potatoes has an opening to form a rest for the operator's arm, and a knife of special shape is secured to the end of a swinging arm, the latter being connected by a link with a treadle. The arrangement is such that a shearing cut is given to the potato, which may be very conveniently handled by the operator.

Miscellaneous.

ORGAN.—Jerzy Polukanis, Bloomfield, N. J. A rapid sounding of the organ pipes is designed to be obtained by the improvement made by this inventor, the performer being also enabled to easily manipulate the keys. A self-acting pneumatic valve is adapted to be actuated by the wind from the wind box, on releasing air from the valve by means of the keys or pedals, the valve being controlled by a preponderance of pressure from the wind box at the time the keys or pedals are actuated.

INKSTAND.—Phineas B. Myers, Brooklyn, N. Y. This is an inkstand provided with one or more racks so arranged that when a particular rack is pressed down, the cover of a corresponding ink well will be automatically opened, the covers of other ink reservoirs remaining closed, enabling a bookkeeper to keep a red ink pen upon a rack operating the lid of the red ink well, the black ink pen being placed on a similar rack for the black ink well, etc., thus preventing the frequently recurring mistake of dipping a pen into the wrong ink reservoir, and enabling the penman to work with perfect safety and dispatch.

GLOVE. — George M. Cluze, Paris, France. This is a new article of manufacture, consisting of a glove almost identical in appearance with the usual style, but having the thumb sewed to it in a particular manner, whereby the seam around the thumb is avoided, and the thumb is rendered yielding in its length, affording greater freedom for the movement of the hand. The seam by which the thumb is secured does not extend to the wristband, nor is it continued to the palm, so that the latter is left perfectly smooth, as in ordinary gloves.

ROLLER SKATE.—Carl Storla, Belford, South Dakota. This skate has a box-like frame containing compartments for holding steering mechanism, wrenches, and other articles, and means are provided for tying the skates together to form a vehicle for carrying the rider. The skates likewise have movable spring-pressed platforms held to move vertically within the box-like body, in connection with a ratchet mechanism for turning the wheels by the downward movement of the platforms, a tripping device automatically releasing the ratchet during the upward movement of the platforms, and the skates being operated by simply shifting the weight of the body from one skate to the other, whereby the skates may be made to run very rapidly.

WASHING MACHINE.—James H. Jones, Floyd, Texas. This device comprises a revoluble cylinder mounted in a casing, there being on the interior of the cylinder slats corresponding to the ribs of the washboard, while in connection therewith is arranged a series of buckets, so shaped as not to present sharp edges likely to injure the clothes, the buckets serving to carry up water and empty it upon the clothes as the cylinder is revolved by means of a crank. The clothes are thus tumbled about as the water is kept in a state of agitation, and the clothes are conveniently washed without a possibility of their being injured.

CONVERTIBLE STOOL.—Frank Graham and Irvine E. Curtis, Easton, Washington. This is a sectional stool which may be folded to incase an umbrella, the whole device being then adapted for use as a walking stick. It consists of an upper and lower series of braces hinged at their adjacent ends to swing outwardly, each brace having an outer hinged section to swing inwardly into a horizontal position, while an annular ring or cap connects the adjacent inner ends of each series of hinged sections. When the stool is folded an open-ended tube is formed to removably inclose an umbrella.

EGG HOLDER.—Abraham A. Anderson, New York City. Two patents have been granted this inventor for a device comprising a frame containing an egg cup or socket, a top ring fitting the upper end of the egg, and a horizontally swinging knife with a circular egg-receiving aperture, and a swinging cover plate also having an egg-receiving aperture, whereby an egg may be securely held and one end cut by the knife, which does not then interfere with the removal of the contents of the shell. The egg may be further cooked if desired, the egg and the holder being together placed in the water. The holder also affords facility for introducing condiments and stirring them within the egg shell. With the holder likewise an egg may be conveniently cooked at the table with an alcohol or other lamp.

POT OR KETTLE SCRAPER.—Peter Unsinger, Fremont, Ohio. This is a flexible scraper to facilitate removing grease and dirt from the sides, bottoms, and corners of pots, kettles, metallic sinks, etc. It consists of a thin steel blade with a handle formed in two parts, each part pivotally connected at its forward end to the blade, and the parts pivotally connected with each other at their rear ends. The scraper readily conforms to the outer surfaces of the pot or kettle, and may be readily introduced into the sharp corners to clean them.

COOKING STOVE.—Albert Loewenthal, Berlin, Germany. This is a portable or pocket stove, comprising a casing formed of two sections fitting one upon the other, each section being provided with a bowl-shaped cavity, the cavity of one section being adapted to receive spirits or alcohol when placed under the other section. The device is specially designed to serve the convenience of travelers, as it can be readily carried and easily set up for use in preparing, cooking, and warming coffee, cocoa, eggs, soup, etc.

BURNER FOR GAS STOVES.—Anton Weiskittel, Baltimore, Md. An annular cup or receiver has an open central air space, and its edges have outwardly flaring beveled surfaces forming a concave seat, in which rests by gravity an annular top having beveled surfaces and radial grooves, the latter serving to conduct off any liquid that may be spilled, and prevent its passing into the cup or receiving chamber of the burner. All separate fastening devices are dispensed with, and access may be readily had to every part for cleaning.

PUMP. — John W. Gregory, Garden City, Kansas. This pump has a displacing cylinder so constructed and arranged that the cylinder may be made of equal weight to the liquid which it displaces, thus reducing the power required to operate it, the relative weight and buoyancy of the displacing cylinder being conveniently adapted or adjusted to different depths of wells or heights to which the water is to be raised.

DESIGN FOR A FLAG.—John Terhune, Hackensack, N. J. This flag has on one side the insignia of Ferdinand and Isabella, and on the other representations of Columbus and his caravels, with characters simulating a page of his log book. The flag is swallow tail in shape, the Maltese cross of the insignia on one side being of comparatively large size.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

JUNE, 1893.—(No. 92.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing the residence of Joseph P. Beach at Pine Orchard, Conn., erected at a cost of $1,200 complete. Floor plans and two perspective elevations. Messrs. Munn & Co., architects, New York.
2. Plate in colors showing the handsome residence of Seward W. Jones, at Newton Highlands, Mass., erected at a cost of $9,000 complete. Perspective view and floor plans. Messrs. Rand & Taylor, architects, Boston, Mass. An attractive design.
8. A handsome colonial dwelling on Beacon Hill, Boston, Mass. Two perspective views and floor plans. A model design. Messrs. Shepley, Rutan & Coolidge, architects, Boston, Mass.
4. A Colonial residence dwelling at Montclair, N. J., erected at a cost of $5,500 complete. Floor plans, two perspective view, etc. Messrs. Munn & Co., architects, New York. An excellent design.
5. Engravings and floor plans of a dwelling at Elm Station, Pa., erected at a cost of $5,200.
6. A dwelling erected near Longwood, Mass. A modern design. Mr. Austin W. Pease, architect, Boston, Mass. Floor plans and perspective elevation. Cost about $2,200.
7. The First Congregational Church at Plainfield, N. J., erected and furnished complete at a cost of $15,000. Mr. Oscar S. Teale, architect, New York City. Perspective and floor plans.
8. A residence at Beardsley Park, Bridgeport, Conn. A very picturesque design, perspective elevation and floor plans. Cost $5,500 complete. Mr. A. H. Beers, architect, Bridgeport, Conn.
9. Views showing the exterior of the twelve story Boyce Building, at Chicago, put up in thirty-nine days. The cost of the structure was $300,000.
10. The Fifth Avenue Theater, New York.—Views of the auditorium, the Broadway lobby, the Twenty-eighth Street foyer. Mr. Francis H. Kimball, architect, New York.
11. Miscellaneous Contents: New lien law in California.—An improved spring door hinge, illustrated.—To estimate brick work.—Foul water main.—An improved woodworking machine, illustrated.—An improved scaffold truss, illustrated.—Sawdust building bricks.—Some beautiful arch work, illustrated.—Mineral wool in buildings.—Wood mantels, illustrated.—Sound titles for real estate.—Durability of cedar.—Tin from tin scrap.—Improved steam heater, illustrated.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural Publication in the world. Sold by all newsdealers. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Order pattern letters & figures from the largest variety. H. W. Knight & Son, Seneca Falls, N. Y., drawer 1115.

Acme engine, 1 to 5 H. P. See adv. next issue.

"U. S." metal polish. Indianapolis. Samples free.

Kemp's Manure Spreader, Syracuse, N. Y. See Adv.

Best drying machines. S. E. Worrell, Hannibal, Mo.

Improved ironplaners. W. A. Wilson, Rochester, N. Y.

For best hoisting engine. J. S. Mundy, Newark, N. J.

Chain Belting & Grain Dryers, F. H. C. Mey, Buffalo, N. Y.

Heading machinery. Trevor Mfg. Co., Lockport, N. Y.

Patent Open-Side Planing and Shaping Machines. Pedrick & Ayer, Philadelphia, Pa.

Microbe Killer Water Filter, McConnell Filter Co., Buffalo, N. Y.

All kinds of Perforating done in every kind of metal F. Erdle Perforating Works, Rochester, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

$5 gauge shows speed and all changes of engines, machinery, etc. G. T. McL. & Co., 120 Fulton St., Boston.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps. Capacity, 100 to 40,000 gals. per minute. All sizes in stock. Irvin Van Wie, Syracuse, N. Y.

To Let—A suite of desirable offices, adjacent to the Scientific American offices, to let at moderate terms. Apply to Munn & Co., 361 Broadway, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

Foundry Business for Sale—N. J. town; 2 railroads. Machinist can make money. Reason for selling, dislike of mfg. business. About $5,000 required. Address Foundry, care of Scientific American, New York.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(5146) F. I. A. asks: 1. Would the microphone described in "Experimental Science" work well as a telephonic transmitter? A. Yes. 2. If so, would it make it better to substitute a diaphragm of tintype in the place of the wooden one? A. Yes; the diaphragm being not more than 2¼ or 2½ inches in diameter. 3. Which of the two motors described in SUPPLEMENT 641 and 759 respectively would give the most satisfaction? A. Probably the motor described in SUPPLEMENT 759 would prove satisfactory.

(5147) F. M. M. writes: In our gas field we have rock pressure of gas 135 lb. Our line pressure is about 125 lb. The question in dispute is this: We have a four inch pipe running from part of our field, say three miles, into the six inch pipe. Parties here claim by placing another three inch pipe alongside the four inch, we would gain pressure by it on the six inch line. We have now, understand, twenty-two miles of six, inch and three miles of four inch. I claim the pressure would be the same, that is, it would equalize on the six, and pressure be the same; but by placing a pump on said line to force from the end of six inch line to city would be far better, and use suction on the four inch line. A. The difference in pressure between the four inch pipe and the six inch pipe is no doubt due to friction. Any additional supply that you can make to the six inch pipe by an additional pipe will increase the flow and tend to equalize the pressure or raise the pressure in the six inch main. A pump will also overcome the difficulty, bnt in general, is expensive for gas transmission.

(5148) N. R. F. asks: 1. Why is it that the wheel of a radiometer always rotates with the white faces in advance when exposed to the sun? A. All radiometers do not turn the same way. At a certain degree of exhaustion the black surface moves toward the source of heat, while at a further degree of exhaustion the white surface moves toward the source of heat. The cause of rotation is supposed to be the difference in the degree of absorption and radiation of heat by surfaces of different colors. The dark surface being hottest repels the molecules of gas. If the gas is sufficiently rarefied the reaction due to such separation turns the vane. If the

© 1893 SCIENTIFIC AMERICAN, INC

gas is not sufficiently rarefied, convection currents are established, causing the blackened faces to approach the source of heat. There is also a degree of rarefaction at which there is a critical point in the conditions of molecular disturbance, when the radiometer ceases to move under the influence of heat. 2. How many people do you think will visit the World's Fair from opening day, May 1, to date of closing? A. Probably several million.

(5149) J. C. R. says: I have a well the water of which is full of Turbellarian worms, thus rendering it unfit for use. Could you suggest a means by which the well could be cleared of the worms? What is the cause of these worms being in the well? Is it on account of some impurity or do they exist in pure water? Please give me a receipt for cheap metallic roof paint which will stand the weather and will not wash off. I would prefer a dark brown. A. Thorough cleaning of the well is recommended. Then, if the worms still come in, put in a trout or frog. The worms probably burrow in the soil around the well and crawl through the curb and drop into the water accidentally. The best paint for roofs is red oxide of iron paint or Prince's metallic paint mixed with boiled linseed oil. Add a little lampblack to give it the required shade. Let the first coat dry well before second coat is put on. Use no turpentine.

(5150) E. A. P.—It is said the surface of tracing cloth may be restored by varnishing the cloth with Canada balsam dissolved in turpentine, to which may be added a few drops of castor oil, but do not add too much, or it will not dry.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

June 13, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Acid, making derivatives of amido-crotonic, L. Lederer ... 499,301
Advertising apparatus, Oliver & Phillips ... 499,570
Advertising blotter, A. R. Baker ... 499,197
Agricultural implement, M. Macleod ... 499,239
Air brake mechanism, Pool & Beals ... 499,582
Alarm. See Burglar alarm.
Alloys of nickel with other metals, manufacturing, F. W. Martino ... 499,559
Aniline black, discharge, W. T. Whitehead, 499,688, 499,691
Aniline black resist, W. T. Whitehead ... 499,689, 499,692
Asphaltic mixtures, apparatus for treating, S. R. Scharf ... 499,256
Autographic register, P. E. Loree ... 499,679
Autographic register, Rex & McNiece ... 499,250
Axle clamp for sleigh attachments for vehicles, G. B. Paquette ... 499,575
Bag handle, J. Swegles ... 499,481
Balance, A. Stocker ... 499,479
Ballot box, duplex, J. W. Ernest ... 499,337
Basic lining, J. Reese ... 499,248
Bath water heater, D. W. Sugg ... 499,403
Beam stirrups, machine for making, W. Crossley ... 499,355
Bedstead, folding, J. A. Dewey ... 499,287
Beehive, L. Wismer ... 499,490
Bell, bicycle, J. D. Nesbitt ... 499,245
Bell, electric, J. L. Moore ... 499,305
Belt, conveyer, T. Robins, Jr. ... 499,472
Belting, leather link, J. K. Tullis ... 499,613
Bicycle attachment, I. Polhamus ... 499,581
Bicycle, etc, W. A. Wright ... 499,694
Bicycle or velocipede saddle, W. L. Fish ... 499,379
Bicycle saddle, Naly & Jones ... 499,244
Bicycle self-timing attachment, M. Friedberger ... 499,221
Bicycle support, G. Finley ... 499,457
Bin. See Flour bin.
Binder, temporary, W. Lumley ... 499,432
Binding strips, machine for making, A. R. Keller ... 499,551
Blanket, electro-magnetic, N. O. Renstrom ... 499,681
Blind stop, Davis & Gartner ... 499,373
Block. See Fuse block.
Board See Game board.
Boiler, J. Player ... 499,587
Bolt for attaching articles to walls, O. F. Schumann ... 499,444
Bookcase shelf roll, C. B. Godfrey ... 499,672
Boot or shoe, W. Wass ... 499,616
Box. See Ballot box. Cigar box. Letter box. Paper box. Turpentine box.
Box, D. S. Clark ... 499,654
Brake. See Car brake. Friction brake.
Brake shoe, A. Brake ... 499,509
Bread knife, J. Brietenbach ... 499,650
Bread or cake warmer, A. W. Davis ... 499,285
Breastpin, J. Friedberger ... 499,356
Brick machine, reciprocating, W. Johnson ... 499,230
Brick mould sander, J. A. Buck ... 499,206
Bridge truss, G. T. Hawes ... 499,631
Brush, W. K. Long ... 499,678
Brush and boxholder, blacking, J. S. Moore ... 499,436
Brush, blacking, T. Haswell ... 499,538
Brush, tooth, D. W. Tower ... 499,612
Buckle and cast-off, W. B. Draper ... 499,214
Buckle, horse blanket, F. J. Herrick ... 499,458
Burglar alarm, W. H. Reiff ... 499,365
Burglar alarm system, A. Stromberg ... 499,261
Burner. See Hydrocarbon burner.
Butter extractor, centrifugal, O. Ohlsson ... 499,392
Cabinet, portable, G. A. Raisbeck ... 499,247
Calipers, J. Bath ... 499,199
Candle holder, Nowotny & Vlasak ... 499,568
Car brake, A. H. Kirker ... 499,553
Car brake, electro-magnetic, J. C. Henry ... 499,543
Car buffing mechanism, G. Westinghouse, Jr. ... 499,335
Car coupling, Dailey & Poffenbarger ... 499,661
Car coupling, C. Lescher ... 499,235
Car coupling, J. A. Markley ... 499,558
Car coupling, Miller & Haas ... 499,639
Car coupling, F. J. Vowles ... 499,267
Car coupling, W. B. Yates ... 499,491
Car door and conductor's observatory, combined, W. Sutton ... 499,604
Car draw gear apparatus, G. Westinghouse, Jr. ... 499,336
Car floor, ventilated, H. M. Minto ... 499,303
Car heater, G. W. Rodgers ... 499,594
Car roof, flanged metal plated and sheeted double, P. H. Murphy ... 499,641
Car spring seat, G. F. Godley ... 499,338
Car, stock, C. L. Travis ... 499,311
Cars, gearing for electric railway, J. C. Henry ... 499,633
Carbonaceous and vapor burning furnace, W. McClave ... 499,642
Carburetor, P. Keller ... 499,655
Carburetor, E. Salomon ... 499,597
Card, playing, S. T. Varian ... 499,406
Carpet stretcher, and tacker, J. O. Clark ... 499,372
Carriage, J. Currier ... 499,452
Carriage step, J. A. Mattson ... 499,327
Cash recorder and check printer, D. Curell ... 499,660
Cash recorder and check printer, T. Pink ... 499,309
Cash register and indicator, C. A. Juengst ... 499,294
Catalogue and index card, A. J. Rudolph ... 499,441
Cement, apparatus for turning over, J. F. De Navarro ... 499,391
Change receiver, O. Leim ... 499,556
Cheese hoop and cutter, J. Black ... 499,626
Chopping machine, L. Genevois ... 499,535
Chuck, J. Emig ... 499,377
Churn, A. M. Lance ... 499,234
Cigar box, W. Pincus ... 499,645
Cigar bunching machine binder clamp, P. Whitlock ... 499,488
Cigar or cigarette mouthpiece, W. C. Baker ... 499,695
Clamp. See Axle clamp. Rubber dam clamp. Track clamp.
Clothes drier, H. A. Eversdyk ... 499,663
Clothes line hanger, J. R. Hoit ... 499,323
Clothes line wire, F. S. Dowell ... 499,528
Clover hulling machines, concave for, M. T. Reeves ... 499,591
Clutch, friction, J. F. Byers ... 499,208
Coat and hat hook, F. Taylor ... 499,609
Coin controlled machine, W. M. Ducker ... 499,453
Coke oven, G. W. Nixon ... 499,565
Collars, cuffs, etc., composition for glazing, A. Viner ... 499,685
Colters, machine for making plow, J. T. Duff ... 499,454
Colters, press for straightening plow, J. T. Duff ... 499,418
Commode, D. K. Osbourne ... 499,438
Commode, J. Towle ... 499,310
Commutator for dynamo-electric machines, H. F. Parshall ... 499,350
Compass joint, F. Aborn ... 499,193
Composing stick, A. A. Hill ... 499,546
Compound engine, concentric, J. Player ... 499,589
Compound engine, tandem, J. Player ... 499,584
Conveyer, J. M. Dodge ... 499,525 to 499,527
Corn crib, J. Beckley, Sr. ... 499,200
Cornice and curtain support, combined window, J. M. Hoffman ... 499,547
Cot or hammock hook, C. S. McRee ... 499,644
Cotton gin, roller, F. L. Montgomery ... 499,560
Cotton grader, L. A. Greene ... 499,358
Coupling. See Car coupling. Hose coupling. Pole coupling. Thill coupling.
Cow tail holder, J. Cooper ... 499,213
Cranes, girder for traveling, H. Weickel ... 499,622
Cuff holder, A. S. Fisher ... 499,219
Cultivator, Cardinal & Love ... 499,415
Cultivator, rotary, J. Carrothers ... 499,211
Cup. See Egg cup.
Current generator, alternating, Stanly, Jr., & Kelly ... 499,446
Current protector, strong, C. D. Haskins ... 499,425
Cut-off engine, variable, J. Abell ... 499,493
Cut-out, P. J. Barrett ... 499,497
Damper regulator, I. Z. Merriam ... 499,435
Dental plugger, pneumatic, J. H. Heivly ... 499,632
Dental vulcanizer, G. B. Snow ... 499,602
Die. See Welding die.
Diffusion cell locking device, H. P. Dyer ... 499,529
Display rack, C. Frankel ... 499,420
Display stand, B. Masse ... 499,326
Display stay for shoes, J. C. F. Dick ... 499,375
Distilling tar, etc., method of and apparatus for, F. Lennard ... 499,557
Distribution systems, safety device for, H. C. Wirt ... 499,275
Ditching scoop, A. G. Myers ... 499,437
Door for cat or dog houses, G. Clement ... 499,656
Door hanger, O. F. Gardner ... 499,222
Douche pan, O. McPheters ... 499,643
Dough receptacles, collapsible cover supporting frame for, K. L. Brewster ... 499,510
Draught device for stacks, B. F. Taylor ... 499,607
Draught equalizer, H. Dickey ... 499,522
Dredging bucket, W. A. Collins ... 499,451
Dress shields, apparatus for manufacturing, S. S. Williamson ... 499,272
Dress shields, apparatus for shaping, S. S. Williamson ... 499,271
Drier. See Clothes drier.
Drill, A. G. Turner ... 499,312
Drying apparatus, F. X. Hooper ... 499,460
Dye, blue, E. Meyer ... 499,243
Dye, blue tetrazo, Bammann & Ulrich ... 499,198
Dye, blue, tetrazo, C. Duisberg ... 499,216
Dyeing and printing, V. G. Bloede ... 499,649
Dyeing aniline black, O. P. Amend ... 499,410
Egg cup and cooker, W. R. Hill ... 499,426
Electric igniting device, W. H. & G. E. Russell ... 499,596
Electric light, G. Sautter ... 499,473
Electric machine regulator, J. C. Henry ... 499,544
Electric switch, J. F. McElroy ... 499,363
Elevator. See Hydraulic elevator.
Elevator, C. W. Baldwin ... 499,496
Elevator gate operating device, T. W. Graham ... 499,357
Elevator indicator, A. L. Meyer ... 499,390
Elevators, electric signaling apparatus for, C. G. Armstrong ... 499,411
End gate, wagon, N. Broadwell ... 499,511
End gate, wagon, J. S. & H. L. Phillips ... 499,579
Engine. See Compound engine.
Envelope, letter, W. McDonnell ... 499,563
Exercising machine, W. J. O. Bryon, Jr. ... 499,205
Extension table, W. D. Stryker ... 499,480
Extractor. See Butter extractor. Staple extractor.
Eyeglasses, De Celles & Wells ... 499,320
Eyeglasses, A. J. Landry ... 499,554
Fan, G. W. Grimes ... 499,421
Fan, exhaust, J. E. Green ... 499,673
Faucet, beer, C. Guenther ... 499,537
Feed roll for opening, picking, and carding machines, A. B. Hanscom ... 499,423
Feed trough, P. Reinhart ... 499,249
Feedwater heater, A. Normand ... 499,567
Fence, W. J. Johnston ... 499,462
Fence ratchet, wire, J. Stauffer ... 499,260
Fencing machine, slat and wire, J. B. & J. E. Solt ... 499,353
Fibers, apparatus for distributing oil, etc., upon, Spivey & Halmshaw ... 499,603
Fibrous material, machine for treating, Adriance & Armstrong ... 499,409
File, letter or bill, W. Lumley ... 499,433
File or index, continuous, A. J. Rudolph ... 499,443
Filter, fresh water, R. R. & C. B. Darling ... 499,284
Filter, non-pressure, F. K. Way ... 499,268
Filter, pressure, C. C. Burke ... 499,515
Fire escape, C. Dobbs ... 499,523
Fire escape, portable, Murphy & Rankin ... 499,562
Fire escape tower, O. Nielsen ... 499,329
Flour bin and sifter, M. S. Sager ... 499,252
Folding table, N. Schumacher ... 499,599
Fork. See Hay fork.
Friction brake, J. F. Byers ... 499,207
Fumigation, E. Watson ... 499,407
Furnace. See Hot air furnace.
Furnace for fusing porcelain, etc., W. M. Sharp ... 499,476
Fuse block, electric, T. J. Fay ... 499,664
Fuse block, multiple, G. T. Voorhees ... 499,614
Fuse block, relay, G. T. Voorhees ... 499,485
Game apparatus, C. H. Burch ... 499,317
Game board, G. W. Seeback ... 499,351
Game counter, C. C. Fields ... 499,218
Garden implement, R. M. Rockey ... 499,251
Garment supporter, W. B Draper ... 499,215
Gas lighting apparatus, electric, T. W. Lane ... 499,298
Gas lighting apparatus, electric, Lane & Lee ... 499,297
Gas, making, E. Tatham ... 499,483
Gas, manufacturing hydrocarbon, J. W. Tallmadge ... 499,606
Gas pressure regulator, D. Wilson ... 499,489
Gate. See End gate. Railway gate. Wire gate.
Generator. See Current generator.
Glass, apparatus for the manufacture of, L. West ... 499,624
Glass carrying vehicle, R. M. Roberts ... 499,593
Glove, E. Smellie ... 499,601
Governor for pumping engines, fluid pressure, F. L. Clark ... 499,450
Governor, speed, W. H. Von Mengeringhausen ... 499,242
Governor speed regulator, F. N. Saylor ... 499,255
Grain purifier, F. M. Schell ... 499,598
Grain scourer and dust collector, combined, A. Heine ... 499,385
Grain separator, C. E. McNeal ... 499,468
Graphoscope, H. Franz ... 499,380
Grinding pan, W. G. Stevenson ... 499,367
Gun barrels to stocks, means for separably attaching, W. Mason ... 499,464
Gun feed, machine, R. J. Gatling ... 499,534
Gun mounting, F. F. Fletcher ... 499,530
Gun sighting apparatus, F. F. Fletcher ... 499,532
Guns, automatic recoil rest for breech-loading, H. Borchardt ... 499,315
Guns, breech mechanism for breech-loading, F. F. Fletcher ... 499,531
Guns, carriage for quick-firing, J. B. G. A. Canet ... 499,516
Guns, coupling for firing pins and pin nuts in bolt, P. Mauser ... 499,328
Guns or cannon, adjusting device for rifling, M. F. Smith ... 499,683
Hair curler, L. E. Pease ... 499,439
Ham holder, M. U. Loree ... 499,238
Handle. See Bag handle. Vessel handle.
Hanger. See Clothes line hanger. Door hanger. Pipe hanger. Trolley wire hanger.
Harness, C. R. Spencer ... 499,684
Hat and coat hook, F. Taylor ... 499,608
Hat blocking process and apparatus, Yule & Baglin ... 499,492
Hay fork, double harpoon clover, D. A. Shank ... 499,258
Heater. See Bath water heater. Car heater. Feedwater heater. Soldering iron heater.
Heating apparatus, steam, F. Kaeferle ... 499,231
Heating hot water and steam, method of and apparatus for, W. Heckert ... 499,322
Heating system, M. W. Bayliss ... 499,412
Heating system, I. N. Gordon ... 499,339
Hinge, electric, W. S. Hull ... 499,428
Hoisting apparatus, N. H. Gilmore ... 499,536
Holdback, vehicle, C. A. G. Swasey ... 499,447
Hook. See Coat and hat hook. Cot or hammock hook. Hat and coat hook. Snap hook.
Hose coupling, electric, H. Sargent ... 499,254
Hot air furnace, W. J. Owens ... 499,573
Hydraulic elevator, S. A. Worcester ... 499,276
Hydrocarbon burner, Lannert & Jeavons ... 499,300
Ice breaking and clearing apparatus, Kruisbrink & Van Leeuwen ... 499,296
Ice splitter, C. R. Day ... 499,286
Incubator, C. W. Robinson ... 499,396
Index and file, book, A. J. Rudolph ... 499,442
Indicator. See Elevator indicator. Railway indicator.
Indicator lock, W. F. Beasley ... 499,500, 499,501
Injector overflow attachment, H. Monk ... 499,640
Irrigating apparatus, R. F. Dockery ... 499,524
Jeweler's Turk's head roll, F. Mossberg (r) ... 11,344
Journal bearing, O. B. Shallenberger ... 499,334
Journal box for shafting, H. P. Humphrey ... 499,429
Keyhole guard, W. F. Beasley ... 499,502, 499,504
Kitchen table and ironing board, combined, J. H. Grossman ... 499,674
Knife. See Bread knife.
Knitting machine, J. Bennor ... 499,648
Knitting machines, needle cylinder for circular, R. W. Gormly ... 499,382
Lace fastener, shoe, J. A. Doherty ... 499,376
Lamp, Argand, F. T. Williams ... 499,273
Lamp burner, R. T. Barton ... 499,499
Lamp chimney attachment, K. N. Hollister ... 499,548
Lamp, electric arc, R. M. Hunter ... 499,676
Lamp extinguisher and wick trimmer, C. Shoettle ... 499,398
Lamp holding ring, T. Hipwell ... 499,386
Lamp shade holder, electric, C. Remhof ... 499,470
Lantern, bicycle, F. Rhind ... 499,440
Last, J. C. French ... 499,669
Lathe attachment, W. Frasier ... 499,289
Letter box, O. L. Mitchell ... 499,465
Light. See Electric light.
Lock. See Indicator lock. Switch lock.
Lock, W. F. Beasley ... 499,503, 499,505
Lock, G. Piddington ... 499,580
Lock and latch combined, A. A. Page ... 499,469
Loom, A. W. Fairweather ... 499,456
Loom for weaving cut pile fabrics, G. A. J. Schott ... 499,474
Loom lingo, G. W. Stafford ... 499,478
Loom shuttle thread guide, R. Orr ... 499,308
Loom, swivel, Smith & Minchin ... 499,399, 499,400
Loom weft stop motion, d'Andria & Slicer ... 499,196
Lubricator, Hay & McIntyre ... 499,541
Lubricator, Mattes & Lewis ... 499,434
Lubricator, H. C. Roller ... 499,595
Magnetic separation and apparatus therefor, process of, Sanders & Thompson ... 499,253
Martingale, gag, D. Petrie ... 499,578
Matrix and matrix assembling mechanism, W. Berri ... 499,278
Measuring device, J. N. Pease ... 499,576
Measuring instrument, electrical, E. Weston ... 499,313
Mechanical power for elevators, etc., P. Sweeney ... 499,605
Metal punching and shearing machine, L. C. Hauber ... 499,540
Metal punching apparatus, C. L. Coffin ... 499,519
Metals, method of and apparatus for uniting, J. H. Bassler ... 499,277
Metals, treating materials containing, R. F. Nenniger (r) ... 11,345
Mill. See Pug mill. Rolling mill.
Mirror, duplex, French & Heald ... 499,630
Miter cutting machine, D. H. Brenner ... 499,202
Mop, T. W. Stewart ... 499,402
Mordant, resist, W. T. Whitehead ... 499,687
Mordant zinc resist, W. T. Whitehead ... 499,690
Motion, clutch mechanism for reversing, M. & C. Heineke ... 499,226
Motor. See Water motor.
Motors and compressors, apparatus for cooling liquids employed in, W. Maybach ... 499,302
Music leaf support, A. J. Lehmann ... 499,555
Music leaf turner, H. Ahlstrand ... 499,195
Music leaf turner, O. W. Newcomb ... 499,680
Necktie fastener, C. Mole ... 499,466
Nickel from ores containing nickel, producing and separating sulphide of, C. C. Bartlett ... 499,314
Numbering and perforating machine, J. Brady ... 499,281
Ore separator, centrifugal, O. B. Peck ... 499,342 to 499,347
Ores, treating, F. R. Carpenter ... 499,318
Overgaiter, F. Fathers ... 499,419
Overshoe, Mattison & Phillips ... 499,241
Ozone, apparatus for the production and inhalation of, M. P. Oudin ... 499,572
Packing, piston, G. H. Reynolds ... 499,471
Packing ring or gasket, rubber, J. J. Voorhees ... 499,266
Packing, rod, J. B. Griswold ... 499,422
Pail, dinner, R. E. Carroll ... 499,628
Pan. See Grinding pan. Vacuum pan.
Pan emptying machine, W. G. Stevenson ... 499,366
Paper box, D. S. Clark ... 499,655
Peas from the vines, gathering and hulling green, R. P. Scott ... 499,397
Pen and penholder, combined, H. Byron ... 499,653
Pen or pencil holder and protector, C. Kertell ... 499,552
Perspectograph, J. H. S. Jechoux ... 499,387
Phonograph, W. Bruenning ... 499,370
Pills, method of and apparatus for manufacturing, S. E. Heineman ... 499,542
Pinking machine, E. W. Silsby ... 499,445
Pipe collar, soil, A. W. Cram ... 499,658
Pipe hanger, Hunter & Cajar ... 499,549
Pipe wrench, Booth & Redfield ... 499,508
Planer, buzz, E. F. Gordon ... 499,290
Plant protector, L. Bricker ... 499,203
Pliers, L. E. Mellen ... 499,638
Plow attachment, A. J. Petch ... 499,577
Pole coupling, vehicle, A. J. Taylor ... 499,404
Pole strap coupler, G. D. Hayes ... 499,225
Power. See Mechanical power.
Press, J. A. Deiss ... 499,416
Projectile, D. B. Wesson ... 499,487
Propelling canal boats by electricity, system of, S. W. Gear ... 499,321
Protector. See Current protector. Plant protector.
Pug mill, J. L. Bowles ... 499,413
Pulley, clutch, C. H. Waterous, Jr. ... 499,617
Pulley, clutch, C. H. Waterous ... 499,618
Punching and riveting apparatus, J. A. Rogers ... 499,331
Puzzle, composite, H. C. Hanson ... 499,383
Rack. See Display rack.
Radiator, J. De Laney ... 499,417
Radiator case, H. H. Welker ... 499,686
Railway, conduit electric, W. R De Voe ... 499,374
Railway crossing, W. S. East ... 499,455
Railway gate, J. Harper ... 499,360
Railway indicator, conductor's, B. W. Carrington ... 499,517
Railway signal, A. D. Vinton ... 499,484
Rasp, A. Weed ... 499,619
Rasp making machine, A. Weed ... 499,620
Rasp punching machines, cutter head for, A. Weed ... 499,621
Recorder. See Cash recorder.
Recorder, J. T. Todd ... 499,610
Register. See Autographic register. Cash register.
Regulator. See Damper regulator. Electric machine regulator. Gas pressure regulator. Governor speed regulator.
Resawing machine, A. J. Haskell ... 499,424
Rolling and condensing metal bars, machine for, B. V. Daelen ... 499,677
Rolling machinery, metal, H. Hewitt ... 499,545
Rolling mill, E. M. Butz ... 499,651
Rolling mill feeding and discharging apparatus, H. E. Sheldon ... 499,259
Rolling mill oiling box, J. Judd ... 499,431
Rolling mill, universal, A. Reese ... 499,590
Rubber, composition of matter as substitute for hard, J. D. Brown ... 499,354
Rubber dam clamp, J. W. Ivory ... 499,550
Rule, roof framing, A. G. Dahmer ... 499,521
Safe, J. F. Schulhoff ... 499,257
Sash, window, F. Valin ... 499,405
Saw frame, hack, F. E. Horne ... 499,227
Sawmill attachment, W. G. Peyton ... 499,246
Saw set, C. C. Taintor ... 499,482
Sawswage, J. R. Kirkpatrick ... 499,295
Sawtooth dressing device, C. H. Weston ... 499,625
Sawing machine, reciprocating circular, G. M. Hinkley ... 499,293
Scale, pendulum weighing, L. C. Farmer ... 499,378
School seat and desk, adjustable, Gard & Wing ... 499,671
Scraper, B. F. Shuart ... 499,477
Sea, apparatus for calming the waves of the, B. B. D'Alessandro ... 499,319
Seat. See School seat. Vehicle shifting seat.
Separation, centrifugal, O. B. Peck ... 499,348, 499,349
Separator. See Grain separator. Ore separator.
Separator, R. A. Stubbs ... 499,262
Sewage, apparatus for treating, J. J. Powers ... 499,583
Sewing machine thread cutter, J. E. Snapp ... 499,352
Sewing machine, wax thread, O. E. Brown ... 499,414
Shafts, vehicle, J. & W. F. Kuykendall ... 499,340
Sheave, F. B. Torrey ... 499,611
Sheet metal salvers, making, Z. T. Hall ... 499,359
Ship's distance from an object, apparatus for determining, E. Baker ... 499,495
Shoe fastening, J. M. Brann ... 499,201
Shoes, manufacture of, A. C. Oppenheimer ... 499,571
Shutter, automatic fire, L. C. Tufts ... 499,647
Sketching apparatus, S. Grefstad ... 499,224
Sifter ash, E. Coon ... 499,282
Signal. See Railway signal.
Silver, composition of matter for cleaning, D. A. Smith ... 499,401
Slip holder and stripper, W. H. Campbell ... 499,371
Snap hook, C. J. Jencks ... 499,361
Snap hook, G. S. Minshall ... 499,304
Snap, spring, E. N. Walker ... 499,615
Soldering iron heater, J. Kampf ... 499,362
Soldering sheet metal cans, machine for, B. J. Malmfelt ... 499,389
Spinning jenny stop motion, B Bodell ... 499,280
Spooling machine, J. W. Foster ... 499,668
Spooling machine stop motion, J. W. Foster ... 499,665
Spooling machine tube holder, J. W. Foster ... 499,667
Spools from fibrous pulp, machine for making, E. Hubbard ... 499,427
Spoon, G. A. Schlechter ... 499,332
Spoons, forks, etc., cleaner for, J. H. Moulder ... 499,467
Spring. See Watchcase spring.
Sprocket wheel, J. A. Brown ... 499,627
Stair curve, W. S. King ... 499,636
Stand. See Display stand. Umbrella stand.
Staple extractor, H. T. Knight ... 499,637
Starching machine, E. Hurlburt ... 499,228
Stay, dress, G. S. Brown ... 499,513
Steel plates, etc., apparatus for shaping, hardening, and tempering, J. B. Armstrong ... 499,368
Steering gear, ship, W. A. Oglethorpe ... 499,569
Stirrup, J. T. Crone ... 499,283
Stove caster, adjustable, Z. D. Morrow ... 499,561
Stove, gas, A. Weiskittel ... 499,623
Stove, gasoline, C. A. Frayer ... 499,220
Stove, heating, W. N. Moore ... 499,306
Stove hood, J. Canavan ... 499,210
Stove reservoir, F. S. Lang ... 499,299
Stove, straw burning, Robinson & Hoopes ... 499,330
Strawboard lining machine, M. F. Wilson ... 499,274
Straw stacker, J. Galland ... 499,381
Structural shape, E. M. Butz ... 499,652
Sugar wagons, machine for dumping, G. Van Wagenen ... 499,265
Sulphur candle or fumigator, R. W. Johnson, 499,324, 499,325
Switch. See Electric switch. Trolley wire switch.
Switch, G. W. Russell, Jr. ... 499,646
Switchboards, system of wiring multiple, C. H. Wilson ... 499,693
Switch lock, F. P. Hilburn ... 499,459
Table. See Extension table. Folding table. Kitchen table.
Tablet, roller, H. T. Wilson ... 499,448
Tapping and emptying device, barrel, S. A. Reinheimer ... 499,592
Tent, E. E. Mann ... 499,240
Test plug, contractible, M. F. Smith ... 499,682
Thill coupling, T. Oliver ... 499,393
Thill coupling, R. M. Shaffer ... 499,475
Tire inflating device, J. F. Cranston ... 499,659
Tire, pneumatic, C. H. Pagett ... 499,574
Tire, pneumatic, W. Sherbondy ... 499,600
Tobacco pipe cap, A. T. Harper ... 499,384
Tobacco pliers, M. B. Hatcher ... 499,539
Toy building, G. L. Brower ... 499,512
Toy detachable animal and vehicle, H. C. Ives ... 499,430
Toy musical, Haub & Dasha ... 499,292
Toy puzzle, W. Schott ... 499,333
Track clamp, J. P. Kimble ... 499,233
Tray, ring, C. A. Troescher ... 499,264
Tree support, W. H. Cook ... 499,520
Trolley wire hanger, C. B. Elliott ... 499,662
Trolley wire safety support, H. K. Whitner ... 499,270
Trolley wire switch, overhead, R. M. Hunter ... 499,461
Trough. See Feed trough.
Truck, hand, J. M. Coffield ... 499,212
Tunneling shield, J. J. Nobbs ... 499,566
Turpentine box, D. W. Ketchum ... 499,388
Twine cutter, Quick & Nelson ... 499,364
Twisting machine, G. L. Brownell ... 499,204
Type, W. W. Bishop ... 499,507
Type setting machine, W. W. & J. M. Bishop ... 499,506
Typewriting machine, W. H. Barten ... 499,498
Typewriting machine, D. H. Taylor ... 499,263
Umbrella stand, B. Bronner ... 499,449
Vacuum pan, W. Walter ... 499,486
Valve motion, compound engine, J. Player ... 499,585
Valve motion for tandem compound engines, J. Player ... 499,586
Valve, reducing starting, J. Player ... 499,588
Valve, steam radiator air, J. H. Lindsay ... 499,463
Vehicle running gear, L. J. Ewell ... 499,288
Vehicle shifting seat, J. B. Armstrong *et al.* ... 499,369
Vehicle wheel, J. Buchanan ... 499,514
Velocipede saddle, Hendrick & Kelly ... 499,675
Vessel handle, C. D. Milne ... 499,341
Vise, C. H. Ayars ... 499,494
Vise, J. B. Gury ... 499,291
Washing machine, E. A. Kibbe ... 499,232
Washing machine, W. M. Lindsey ... 499,237
Washstand and dressing case, combined, A. Wettervik ... 499,408
Watchcase spring, V. Nivois ... 499,564
Water closet bowl, F. Adee ... 499,194
Water motor, W. R. White ... 499,269
Water wheel, A. B. Frame ... 499,533
Weather strip, E. C. Ellis ... 499,629
Weighing machine, automatic, C. R. Gorringe ... 499,223
Welding die, link, J. W. R. Johnson ... 499,229
Welding metals, electrically, C. L. Coffin ... 499,518
Welding sheet metal, method of and apparatus for electrically, C. L. Coffin ... 499,657
Wells, rod adjuster, and clamp for artesian or oil, G. S. Gahagan ... 499,670
Wheel. See Sprocket wheel. Vehicle wheel. Water wheel.
Whiffletree center, J. Edgar ... 499,217
Whisky making, W. E. Bradley ... 499,316
Whistle, air alarm, Campbell & McHugh ... 499,209
Winding machine, spool or quill, A. Insinger ... 499,634
Winding machine twisting attachment, J. W. Foster ... 499,666
Windmill, T. O. Perry ... 499,395
Windmill governing mechanism, T. O. Perry ... 499,394
Window, J. Lewis ... 499,236
Wire gate, C. B. Bird ... 499,279
Wire stretcher, J. W. McKinney ... 499,307
Wrench. See Pipe wrench.

TRADE MARKS.

Beer, lager, Bartholomay Brewery Company ... 23,209
Butterine, Swift & Company ... 23,201
Cheese, B. S. Janney, Jr., & Co ... 23,202
Chocolate icing, A. H. Stillwell ... 23,300
Cigars, stogies, cheroots, and cigarettes, and smoking and chewing tobacco, Baer Brothers ... 23,198
Disinfecting chemical compound for purifying water, J. Q. Lemmon ... 23,217
Electric batteries, open-circuit, P. C. Burns ... 23,219, 23,220
Fabrics of wool, worsted, hair, silk, linen, hemp, and cotton, piece, Dr. Jaeger's Samtary Woolen System Co ... 23,196
Food and systemic tonic and restorative, liquid, F. A. Lovecraft ... 23,210
Guitars, mandolins, banjos, and zithers, W. J. Dyer & Bro ... 23,193
Hosiery and underwear, Wilcox & Gibbs Sewing Machine Company ... 23,194
Lamp chimneys, F. W. Buning ... 23,218
Laxative, Bordeaux Prune Company ... 23,214
Lead and zinc, compound of white, Mound City Paint and Color Company ... 23,207
Liniments, A. W. Sward ... 23,216
Medicine for use in fevers, tonic, Diffusible Tonic Company ... 23,211
Paint for covering wood and iron, Thomas & Klein ... 23,206
Paints, prepared, Lowe Brothers ... 23,205
Polishing substance for use on metal and glass, Moram Bros ... 23,204
Remedies, certain named, B. Fisher ... 23,212
Remedies for gonorrhea, J. Kremer ... 23,213
Sewing machines, H. R. Tracy ... 23,222
Skins or hides or hides treated with patent-leather composition for shoes, etc, G. F. Stengel ... 23,197
Soap, toilet, laundry, and scouring, Ke-Li Manufacturing Company ... 23,203
Stays, dress, F. Hinckel ... 23,195
Tobacco, smoking, English, Belcher & Co ... 23,199
Trunks, professional, theatrical, and commercial travelers', C. A. Taylor Trunk Works ... 23,221
Veterinary powders, J. P. Hull Horse, Cattle, and Poultry Powder Company ... 23,215
Waters, both plain and aerated, spring and mineral, E. E. Hoyt ... 23,208

DESIGNS.

Badge, L. J. Chandler ... 22,528
Badge, C. E. Long ... 22,529
Bowl, sugar, H. Berry ... 22,530
Can opener handle, F. E. Kohler ... 22,533
Cap, Grunewald & Gauger ... 22,520
Cape, L. H. Weil ... 22,521
Coffin handle, O. McCarthy ... 22,535
Display stand, C. B. Morrow ... 22,538
Dough cutting die, J. J. Pfenninger ... 22,532
Finger ring gauge, J. W. Ford ... 22,531
Flower bed support for graves, G. W. Burns ... 22,536
Penholder, D. L. Lydick ... 22,523
Penholder handle, Eckert & Cohen ... 22,524
Plaque, L. Tonetti ... 22,522
Plate lifter, W. T. Russell ... 22,534
Radiator, E. Gurney ... 22,544
Sewing machine frame, H. R. Tracy ... 22,525
Spoon, etc., H. W. Hirschfeld ... 22,526
Spoon, A. F. Koch ... 22,527
Spoon, C. E. Pretat ... 22,537
Stable comb, F. E. Kohler ... 22,541
Stove, fireplace, T. I. Rankin ... 22,542
Stove, heating, G. H. Holland ... 22,540
Stove, lamp, J. F. Myers ... 22,539
Table, A. Nacke ... 22,539

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

© 1893 SCIENTIFIC AMERICAN, INC

Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line

Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

LATHE

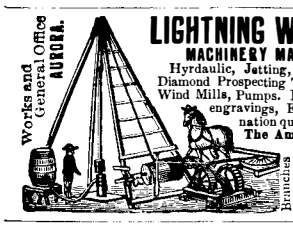
Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co. 695 Water St., Seneca Falls, N.Y.

IMPROVED ENGINE **LATHES** MODERN DESIGNS

Also Foot Lathes, Tools and Supplies. Catalogue Free

Sebastian Lathe Co. 120-122 Culvert Street CINCINNATI, OHIO.



LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.

Hyrdaulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. **Encyclopedia,** 1,000 engravings, Earth's Strata, Determination quality water; mailed,25c.

The American Well Works, Aurora, Ill.

11 & 13 S. Canal St., Chicago, Ill.

Dallas, Texas.

OIL WELL SUPPLY CO.

91 & 92 WATER STREET, PITTSBURG, PA.

Manufacturers of everything needed for

ARTESIAN WELLS

for either Gas, Oil, Water, or Mineral Tests Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. *Illustrated catalogue, price lists, and discount sheets on request.*

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **59.** Price 10 cents. To be had at this office and from all newsdealers.

NEW DEPARTURE IN LANTERN PROjection, by means of the ***Incandescent Electric Current,*** both alternating and direct, with the

PARAGON ARC LIGHT PROJECTOR.

Send for Catalogue to **QUEEN & CO., Phila.**

BARNES' New Friction Disk Drill.

FOR LIGHT WORK.

Has these Great Advantages:

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage. Send for catalogue.

W. F. & JNO. BARNES CO.,

1999 Ruby St., - Rockford, Ill.

THE MODERN MARINE BOILER.—By A. B. Willits, U.S.N. Description of the principal features of the boilers of the United States man-of-war New York, with a plea to inventive minds for the production of a type of boiler which shall do away with the necessity of the present enormously large and heavy shells, and present a lighter substitute that will perform the duties of both envelope and heating surface conjointly. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **870.** Price 10 cents. To be had at this office and from all newsdealers.

Steel Type for Writing Machines,

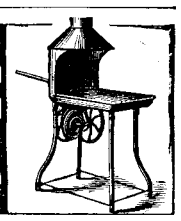
J. D. MALLONEE, M'f'r, STOCKTON, N. Y.

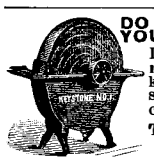
THE STURTEVANT **PORTABLE FORGES** ALL SIZES & STYLES

SEND FOR CATALOGUES TO

B.F.STURTEVANT © BOSTON MASS.

NEW YORK. PHILADELPHIA. CHICAGO. LONDON.





DO YOU **USE GRINDSTONES?**

If so, we can supply you. All sizes **mounted** and **unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue.*

The CLEVELAND STONE CO.

2d Floor, Wilshire, Cleveland, O.

SMOKELESS POWDER AND MAGAzine Rifles.—By L. G. Duff Grant. An interesting paper on the various smokeless powders for military purposes now in existence, and the weapons mostly used therewith. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **892** and **893.** Price 10 cents each. To be had at this office and from all newsdealers.

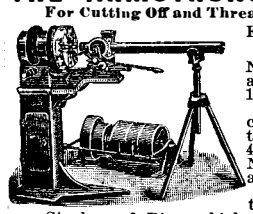
CATALOGUES FREE TO ANY ADDRESS

GEARS AND PARTS OF MODELS

GOODNOW & WIGHTMAN BOSTON

THE ARMSTRONG MACHINES,

For Cutting Off and Threading Pipe.



For Hand or Power.

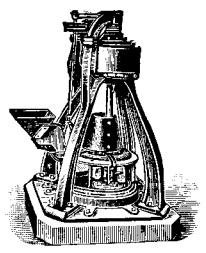
No. 1 cuts off and threads 1 to 3 inch.

No. 2 cuts off and threads 1 to 4 inch.

No. 3 cuts off and threads **1 to 6 inch.**

Our aim is to make these machines as good as our Stocks and Dies, which are universally acknowledged to be **THE BEST.** ☞ Send for catalogue.

THE ARMSTRONG MFG. CO., Bridgeport, Ct.



THE GRIFFIN MILL

A perfect pulverizer of all refractory substances by either the wet or dry process. It works better and at less expense than any other Mill, and is conceded to be the only perfect pulverizing Mill manufactured.

For FREE Illustrated Pamphlet address

BRADLEY FERTILIZER CO., 92 STATE ST, BOSTON.

SPECIAL NOTICE!

Two handsome photo-engraved display sheets entitled,

"Recent Improvements in Air Compressors,"

"Recent Improvements in Rock Drills,"

mailed free to any one who will cut out this advertisement and mail it to us with his name and address.

INGERSOLL-SERGEANT DRILL CO.

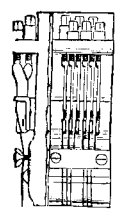
Havemeyer Bldg., Cortlandt St., New York, U.S.A.

ROCK DRILLS AIR COMPRESSORS & GENERAL MACHINERY FOR MINING, TUNNELING, QUARRY & RAILROAD WORK.

RAND DRILL Co 23 PARK PLACE NEW YORK

Rubber Rolls and Wheels.

Power Wringing Machines, Drying and Ventilating Fans. All styles of Trucks made to order. Catalogues free. **GEORGE P. CLARK, Box L, Windsor Locks, Conn.**



MASON & HAMLIN SCREW STRINGER

One of the greatest improvements in the history of the Piano Forte.

Keeps the Piano in Tune. Much More Durable. Quality of Tone Purer.

☞ *Fully Illustrated Catalogue sent on application.*

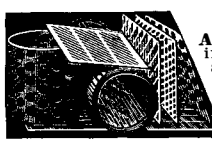
Mason & Hamlin Organ & Piano Co.

152 TREMONT ST., BOSTON, MASS.

MECHANICS' TOOLS.

If you are interested in Tools as a manufacturer or amateur, you should have a copy of our new catalogue. Our 1892 edition is a very elaborate and complete book of 704 pages, handsomely bound in cloth. The book will be sent to any part of the world, prepaid, on receipt of $1.00, and the money thus paid will be refunded with the first purchase amounting to $10.00 or over. Every manufacturer and amateur should have this catalogue, even if they do not intend buying their Tools and Supplies of us.

MONTGOMERY & CO., Fine Tools, 105 Fulton Street, New York City, N. Y.



STEEL, IRON, COPPER, ZINC, BRASS, TIN,

And all other Metals Perforated as Required for Grain Cleaning and Mining Machinery, Woolen, Cotton, Paper and Pulp Mills, Rice, Flour and Oil Mills, Sugar and Malt Houses, Distilleries, Filter Presses, Stone, Coal and Ore Screens, Brick and Tile Works, Filters, Spark Arresters, Gas and Water Works, Oil, Gas, and Vapor Stoves, Coffee Machinery, etc., etc. Standard Sizes Perforated Tin and Brass always in Stock.

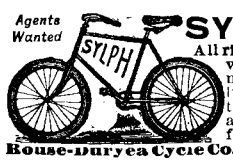
THE HARRINGTON & KING PERFORATING CO., Chicago,

And 284 Pearl Street, New York.

MINING AND PROSPECTING TAUGHT BY MAIL

Also, MECHANICAL DRAWING, *Mechanics, Arithmetic, etc.* To begin, students only need know how to read and write. **DIPLOMAS** Awarded. **Low Prices.** Send for FREE Circular to **The Correspondence School of Mines, Scranton, Pa.**

Agents Wanted

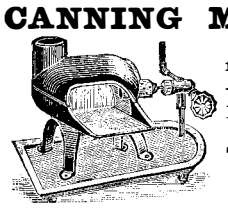


SYLPH CYCLES RUN EASY

All riders say. Our spring frame with pneumatic tires saves muscle and nerve and is luxury indeed. You want the best. Investigate. We also make a 30 pound rigid frame Sylph. Cata. free.

Rouse-Duryea Cycle Co. *Mfrs.* 16 Gst., Peoria, Ill.

CANNING MACHINERY



OIL BURNERS

for soldering and tempering

Air Pumps, Can Wipers, Labeling Machines, Presses and Dies, AND **Tin Working Mach'ery**

BURT MFG. CO. Rochester, N. Y.

LIQUID FUEL FOR STEAM MAKING.—By F. R. Hutton. A paper pointing out the advantages of partially refined and crude petroleum for boiler firing. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **896.** Price 10 cents. To be had at this office and from all newsdealers.

CLAY & TORBENSEN GLOUCESTER CITY, N.J.

DESIGNERS & BUILDERS OF YACHTS, LAUNCHES AND SAILING CRAFT.

SEND 8 CENTS FOR CATALOGUE.

WEBER GAS AND GASOLINE ENGINE

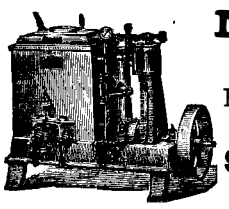
Simplest and most economical engines on earth.

Fully Guaranteed.

A boy starts it, requires only a few minutes' attention a day. Guaranteed cost of running 1 ct per hour per H. P. Write for catalogue. Address Drawer 200,

Weber Gas & Gasoline Engine Co. KANSAS CITY, MO.

FOR SALE.—Patent No. 498,896, Steam Hammer. For particulars, address Chas. Deyherle, Iron Mountain, Mo.



NO SKILLED ENGINEER.

THE SHIPMAN AUTOMATIC STEAM ENGINE.

KEROSENE OIL FUEL. 1, 2, 4, 6 and 8 HORSE POWER

No extra Insurance. Efficient, Economical, Durable.

SHIPMAN ENGINE COMPANY,

200 SUMMER STREET, BOSTON MASS.

KING OF THEM ALL.

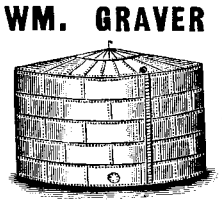
24 Page Catalogue Free. Agents Wanted.

MONARCH CYCLE CO.

Lake and Halstead Sts., CHICAGO, U. S. A.

WM. GRAVER TANK WORKS,

(INCORPORATED.)



Manufacturers of Iron and Steel

STORAGE TANKS.

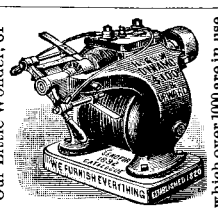
OFFICE,

3d Floor, Rookery Bldg.

CHICAGO, ILL.

MODEL WORK.

Estimates given for the manufacture, in quantities, of any article in metal or wood. Coin operated slot machines a specialty. Send stamp for catalogue. **Amer. Vending Mach. Co.,** 29 Murray Street, **New York.**



NICKEL AND ELECTRO-PLATING

Apparatus and Material.

THE

Hanson & VanWinkle Co.

Newark, N. J.

81 LIBERTY ST., N. Y.

23 S. CANAL STREET, CHICAGO.

Columbian Exposition Electrical Bldg., Section L, Col. 4

212° FAHR. THE STEAM JACKET
FEED WATER BOILER AND PURIFIER
BOILS THE WATER
Wm. BARAGWANATH & SON
46 W. DIVISION ST.
SEND FOR CATALOGUE. CHICAGO.

EAGLE BRAND THE BEST

ROOFING

Is unequaled for House, Barn, Factory or Outbuildings, and costs half the price of shingles, tin or iron. It is ready for use, and easily applied by any one. Send stamp for samples, and state size of roof.

EXCELSIOR PAINT AND ROOFING CO. 155 & 157 Duane St., New York, N. Y.

The Shimer Cutter Heads

45,000 SOLD.

To work Car Siding, Flooring Ceiling and Ship Lap; to Mould Doors, Sash and Blinds. Cope Heads to match.

Sam'l J. Shimer & Sons, Centre St., Milton, Pa.

FRUIT EVAPORATOR

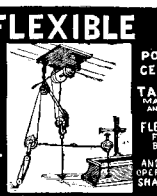
"The Granger." For family use. *Cheapest in the market.* $3.50, $6 & $10. Circular

Eastern Mfg. Co., 259 South 5th St., **Phila., Pa.**

STOW FLEXIBLE SHAFT.

INVENTED AND MANUFACTURED BY THE

STOW MFG. CO. 440 STATE ST.



PORTABLE DRILLS. CENTRE GRINDERS.

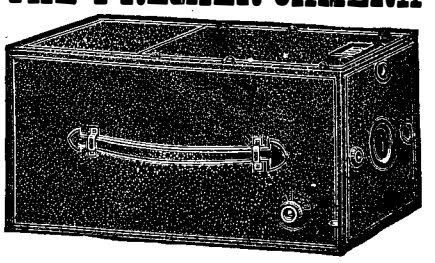
TAPPING & REAMING MACHINES FOR BOILER AND BRIDGE MAKERS USE.

FLEXIBLE BORING MACHINES FOR CARRIAGE MAKERS AND BLACKSMITHS USE.

AND ALL KINDS OF TOOLS OPERATED WITH THE FLEXIBLE SHAFT.

BINGHAMTON, N.Y.

THE PREMIER CAMERA



IS THE BEST IN MARKET.

Simple of Manipulation.

Plates or Films are used.

The Shutter is always set.

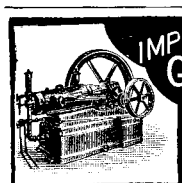
PRICE $18.00.

Send for Catalogue and copy of Modern Photography.

WE MAKE ALL KINDS OF CAMERAS.

ROCHESTER OPTICAL COMPANY,

14 S. Water St., ROCHESTER, N. Y.



IMPROVED CHARTER GAS ENGINES. 2 TO 50 ACTUAL H.P.

USING GASOLINE, COAL GAS, NATURAL OR PRODUCER GAS

RELIABLE. NO DELICATE PARTS. ECONOMICAL. SIMPLE. SAFE

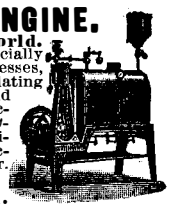
SEND FOR CATALOGUE. **H.W. CALDWELL & SON.** SOLE M'F'R'S.

WASHINGTON & UNION ST'S. CHICAGO. ILL'S.

OLDS' GASOLINE ENGINE.

Best small power in the world.

One and Two Horse Power, specially adapted for running Printing Presses, Sewing Machines, Lathes, Ventilating Fans, Ice Cream Machines, etc., and for use in small shops and manufactories requiring a *Simple, Safe, Economical* and *Durable* Motor. No engineer. No extra insurance. Satisfaction guaranteed. Send for circular.



P. F. OLDS & SON, 218 River St., Lansing, Mich.

THE

SCIENTIFIC AMERICAN

☞ **ESTABLISHED 1845.**

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage.

Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

THE

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York,

Building Edition.

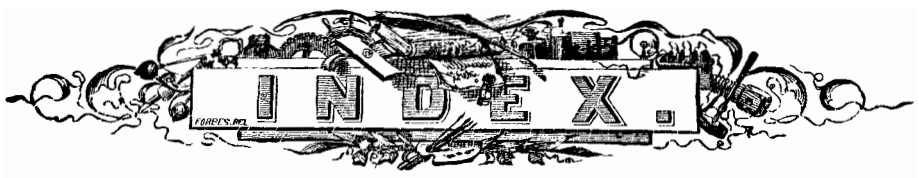
THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors,* and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Plans, Descriptions, Loeations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers, 361 Broadway, New York.

© 1893 SCIENTIFIC AMERICAN, INC



ILLUSTRATIONS.

A

Aard-varks 74
Agami or trumpeter 314
Animals, rare, for Chicago 281
Arbor press, Greenerd 245
Armadillos 74
Atmosphere, pressure 102
Awning, window, Branner's 164
Axle box, car, improved 196

B

Bagasse carrier 104
Baltimore, cruiser in dock 216
Bath Iron Works 97
Bats and balls, racquet and tennis 232
Battleship Iowa 153
Beds, attachment for 213
Belt, electric 277
Belt guide and tightener 52
Belt tightener 36
Bicycle industry 180
Bicycle, Jenkins' 69
Bicycle, Lovell 117
Bicycle, Mail, safety 245
Bicycle stand 388
Binder, shock, Unruh's 133
Birds that nest in cavities 218
Bit brace ring 277
Boat, petroleum 340
Boiler, cooking 296
Boiler furnace, Richard's 229
Boiler, steam, Hise's 69
Boilers for cruiser Cincinnati 216
Bookholder, Gardiner's 181
Borer, hickory bark 148
Boring tool, recess 261
Boston harbor improvements 161
Bottles, leathern 308
Brace, bit, Knudsen's 20
Bracket for miner's lamps 181
Bread kneader, Stone's 4
Bridge, Garibaldi, Rome 150
Bridge, German, highest 379
Bridge moved by rail 193
Bridge, Pecos River 81
Bridge and "L" connections 245
Buckle, Aylsworth's 196
Building, cyclone 4
Burner, crude oil 181
Button, pearl, industry 260

C

Cable grip mechanism 313
Cable railway, Broadway, N. Y. 249
Cable railway, New York 305
Calking tool, Walton's 310
Camera lucida, improved 196
Campania, steamship 155
Cans, tin, utilization 186
Car axle box, improved 196
Car coupling, Smith's 213
Car coupling, Vogt's 230
Car, mine, Durand's 180
Car, passenger, Tillson's 101
Car, sleeping, Sneckner's 213
Car window holder 345
Carriage indicator, Blake's 361
Casket, Shaksperian 372
Cats, performing 72
Cattle group, World's Fair 259
Cave, marble, of Missouri 65
Cells, storage, for amateurs 134
Chair, rocking, electric 276
Chair, rolling 371
Chair and desk, adjustable 20
Chimney struck by lightning 69
Christopher Columbus, steamer 297
Chuck, lathe, independent 196
Cincinnati, cruiser, boilers for 216
Clock for America 372
Clock, electric 373
Clothes drying frame 342
Coach, railway, Tillson's 101
Coal washer, improved 20
Coins, trick with 276
College, Columbia 9
Colon, Cristobal 244
Columbus, squadron of 265
Conduit electric railway 356
Conveyor, Tench's 20
Cooking vessel 36
Copyholder, Gardinier's 181
Cotton picker, pneumatic 361
Coupling, car, Smith's 213
Coupling, car, Vogt's 230
Crane, traveling 298
Cranes, traveling, new 353
Crank shaping machine 180
Crucible, electric 292
Cruiser Baltimore in dock 216
Cruiser Cincinnati, boilers for 216
Cruiser Maine, progress 185
Cruiser Pamyat Azova 265
Cruiser Vesuvius, trial 88
Curious tree growth 390
Cutting-off machine 5
Cycle, Lovell 117
Cyclone building 4
Cylinder, steam, large 145

D

Desk attachment, Neff's 389
Device, vessel stopping 388
De Witt Clinton, trial trip 289
Dinosaurs, gigantic 137, 138
Dough kneader 4
Draisine, of 1816 180
Drowning, rescue from 360
Drill, air, Wilderman's 101
Drying frame, clothes 342
Dumbwaiter, Larsen's 229
Dust and sand figures 202
Dynamite, manufacture of 132
Dynamo engine, Corliss 200

E

Eclipse, solar, path of 262
Effigies, intaglio, Wisconsin 390
Egg puzzle, Columbian 281
El Rio, steamer 202
Electricity, generating, new art of 99
Elevator shifting device 117
Elevator, Tench's 20
Elms, twin 356
Eirie, steamer, accident to 116
Engine dynamo, Corliss 200
Engine, gas, Biggar's 133
Engine, hoisting, Bacon's 341
Engine, traction, Stout's 117
Engine, traction, Stratton's 185
Engines, petroleum, at the Fair 340
Engineering build., Pa. College 214
Entrances, Exposition 169
Entrances, World's Fair 139
Erosion, recent, in Indiana 152
Evaporator, triple effect 228
Exposition at Lyons 388
Exposition ground, map of 275
Exposition, Japanese at 392

F

Factory driving, electrical 200
Fair, World's, map of 295
Feed-water regulator 261
Fence wire stretcher 149
Festivities, naval, Columbian 273
Filter, water, germ proof 214
Filters, inexpensive 300
Fire apparatus, Pauly's 85
Fire escape, Bruce's 101
Fire protection for iron work 229
Fireworks in miniature 40
Flying machine, Langley's 246
Focusing device for telescopes 344
Foundations, concrete 248
Fountain at Vienna 217
Fountains, luminous 52
Fox dog, Siberian 123
Food, canned 296
France, statue 358
Furnace, boiler, Lawton's 245
Furnace, boiler, Richard's 229
Furnaces, electric 292

G

Garibaldi bridge, Rome *149
Gas engine, Biggar's 133
Gas supply for New York 113
Gate worker, automatic 73
Gauges, water, valve for 101
Gold and silver, recovery of 169
Goldsmiths' work, English 372
Grip, cable, mechanism 313
Gun, rapid fire, navy 376
Gun, Krupp, shipment 243
Guns, Krupp 227

H

Hammer, steam, 100 ton 362
Harrow, an improved 197
Hawaiian Islands, annexation 82
Heater, electric, for cars 198
Hecla, broken shaft of 345
Hemerograph, Blain's 196
Hickory carved by worms 148
Hoisting engine, Bacon's 341
Horseshoe sharpener 85
House moving, feet in 91
Hybrids, strange 123
Hydraulic wheel press 389
Hygroscope, simple 309

I

Ibex kids 123
Ice in the subway 152
Improved pinch bar 388
Improved road gate 389
Improvement models, harbor 391
Indicator, carriage, Blake's 361
Indicator coil, new 149
Instruments, musical, oldest 197
Intaglio effigies, Wisconsin 390
Iron structures, cooling 229
Iron works, Bath 97
Iowa, battleship 153

J

Japanese at Exposition 392
Jetties on Brazos River 41

K

Kangaroo as prize fighter 25
Katahdin, ram 97
Kingfisher, nest of 218
Knife grinder, automatic 213
Knife, Nubian 390
Krupp exhibits, Chicago 228, 244
Kurfurst Friedrich Wilhelm 264

L

Ladder and truck, improved 375
La France, statue 358
Lamps, miners', support 181
Lantern, electric light 373
Lantern slide coloring 153
Lantern slide changer 212
Lantern slides, viewing 41
Lathe chuck, independent 196
Laundry, steam, modern 17
Leveling instrument, Merrill's 245
Lewis, Mrs. A. S 346
Liberty, statue of 280
Light, refraction and dispersion 392
Lock, sash, Kirby's 345
Locomotive 999 311
Locomotive cab seat 36
Locomotive, English, large 212
Locomotive, engineers' 280
Locomotive, gas, Biggar's 133
Locomotive, monster 129
Locomotive valve, Kinney 165
Locomotives, 1831 and 1893 289
Lurs, bronze, ancient 197
Lyons Exposition 388

M

Maine, cruiser, progress 185
Man, the steam 233
Mangle, Hagen 357
Manger, Vender's 55
Map of exposition grounds 275
Map of marble cave 70
Marble cave of Missouri 65
Mauna Loa, volcano 121
Mill, rolling, large 361
Mill, sugar, in Cuba 105
Millstone, vertical, Mantey's 53
Mine car, Durand's 180
Mixer, quick delivery 295
Measuring and drawing tool 309
Money maker 84
Monitor Terror 177
Monsters, extinct 137
Motor, Havlina's 181
Motor, heat, novel 182
Motor, light and simple 85
Motor, water, Partridge's 22
Motors, petroleum, at the Fair 340

N

Neff's desk attachment 389
N. Y. harbor imp. models 391
New York, steamer 136
New York, warship 369
Nubian knife 390
Numbering machine, Bates' 247

O

Oyster grounds, S. Carolina 121

P

Painting machines, World's Fair 257
Pamyat Azova, cruiser 265
Parade, naval, and review 273
Parliament buildings, Ottawa 8
Pearl button industry 260
Pecos River bridge 81
Pedal attachment, organ 52
Pendulum, compensation 151
Petch's plow attachment 389
Petroleum engines at the Fair 340
Phonographic message, Pope's 308
Phosphate washer, Beaty's 164
Photo opera glass 248
Photography, automatic 170
Photography, recreations in 184
Pianos, stringing 214
Pichiciago, the 75
Pillows, wire, braided 375
Pinch bar, improved 388
Planter, potato, Sturdy's 342
Plow attachment, Petch's 389
Pneumatone, Mudge's 36
Pocket safety 357
Pope, phonographic message 308
Port office, Baltimore 346
Potato planter, Sturdy's 342
Power house of cable road 312
Power, transmission, Edison's 296
Press, arbor, Grenard 245
Prestidigitation 276
Prison construction, improved 209
Projectile, Rapieff 88
Proving grounds, Fontainebleau 106
Puzzle, egg, Columbian 281

R

Racquet and Tennis Club, N. Y. 225
Rafts, military 308
Railway block signal 214
Railway, cable, Broadway, N. Y. 249
Railway, cable, New York 305
Railway coach, Tillson's 101
Railway, electric, conduit 356
Railway, elevated, electric 40
Railway exhibit, English 212
Railway, overhead propelled 53
Railway, roadbed 292
Railway tie, metallic 373
Ram Katahdin 97
Recess boring tool 261
Refraction and dispersion, light 392
Regulator, feed water 261
Review, naval, presidential 273
Ring, bit brace 277
Roadbed, railway 292
Road gate, improved 389
Rubber toys, improved 197
Ruric, warship 37

S

Saddle attachment 261
Sand and dust figures 202
Sandstone quarries, Potsdam 1, 3
Santa Maria, Nina and Pinta 265
Sash lock, Kirby's 345
Sausage casings holder 247
Saw guide, improved 149
Scaffold truss 277
Scale, universal 182
Scorpion, deadly 283
Screw driver, labor saving 118
Seat, locomotive cab 36
Shaft, broken, of Hecla 345
Shaft of Umbria, repair, 24, 49, 56, 57, 58, 59, 84
Sharpener, horseshoe 85
Shield, Columbian 372
Ship of war, German 264
Ship of war Iowa 153
Ship of war Maine 185
Ship of war New York 369
Ship of war Pamyat Azova 265
Ship of war Terror 177
Ship, Viking 309
Ship, Viking, Exposition 393
Shock binder, Unruh's 133
Siemens, Dr. Werner Von 21
Signal, block, railway 214
Skating rink, Paris 11
Sketching apparatus 73
Sleighs, variety in 37
Slide changer and eclipser 212
Snow shoe exercises 73
Soap bubble experiments 266
Speaking tube 6
Sprinkler, automatic 261
Stand, bicycle 388
Standard of Castile 244
Statue of Liberty 280
Steam pressure recorder 295
Steamer Christopher Columbus 297
Steamer El Rio 201
Steamer Erie, accident to 116
Steamer New York 136
Steamer, war, first, launch 233
Steamship Campania 155
Stone breaker, Austin's 165
Storage cells for amateurs 134
Stretcher, fence wire 149
Strip, the electrician 293
Structures, iron, cooling 229
Subway, ice in the 152
Sugar house in Cuba 104
Sundials, modern 148
Switch operating device 373

T

Table, extension, improved 134
Telautograph 198
Telegraph, printing, Equitable 99
Telephoning, long-distance 106
Telephotos, Boughton's 5
Telescopes, focusing device for 344
Tellurian, Dunham's 197
Tennis and Racquet Club, N. Y. 225
Terrier, the electrical 293
Terror, warship 177
Tie, railway, metallic 373
Tie dog for rails 276
Tile, side and roofing 4
Time system, electric 373
Tin cans, utilization 186
Tomlinson, Lawrence 59
Tool for watchmakers 6
Torpedo cruiser Vesuvius 88
Toy, a novel 72
Toys, rubber, improved 197
Traction engine Stratton's 185
Traction engine, Stout's 117
Tree growth, curious 390
Tree growths, curious 293
Trick with flowers 36
Trolling with live fish bait 71
Trumpeters, the 314
Trunk and bookbinders' boards 9
Truss, scaffold 277
Typewriter, National 27

U

Umbria, shaft of, repair 49, 56, 57, 58, 59, 84
Unicycle, Imlah's 260

V

Valve, locomotive, Kinney 16
Valve, suction, Brenner's 229
Valve for water gauges 101
Veragua, Duke of 244
Vessel, jet-propelled 277
Vessel stopping device 388
Vessels, sunken, how raised 166
Vesuvius, cruiser, trial 88
Victor "Flier" of 1893 180
Victoria building, Chicago 68
Vienna and China juxtaposed 372
Viking ship 309
Viking ship, Exposition 393
Vision, persistence of 43, 215
Volcano of Mauna Loa 121

W

Warship, German 264
Warship Iowa 153
Warship Maine 185
Warship New York 369
Warship Pamyat Azova 265
Warship Ruric 37
Warship Terror 177
War steamer, launch of first 233
Washer, drier and separator 356
Washer, phosphate, Beaty's 164
Wasp, mud 39
Water cooler 214
Water gate, Norton's 21
Water gauges, valve for 101
Water, hot, distribution of 120
Water jet propulsion 277
Water level recorder 295
Wheel press, hydraulic 389
Wheel, water, Potsdam Co.'s 38
Windmill exhibit, Chicago 337
Window holder, Kirby's 345
Wine and water trick 276
Wire, barbed, French patent 283
Wood, Sir E. Trueman 68
Woodpecker, nest of 218
Wood sawing machine 340
Worms, hickory carved by 148
Wrench, Kaltanbeck's 165
Wrench, Kraft's 117
Wrench, Wells' 356
Wrench and cutter 277

Y

Yerkes, Charles T 54

MISCELLANY.

Figures preceded by a *star* (*) refer to illustrated articles.

A

Aard-varks *74
Accumulator, Tommasi's 35
Acid, acetic, as menstruum 330
Acid, acetic, from paper 18
Acid, boric, in beer 120
Acid, carbonic, warmth from 53
Acid, citric, as water purifier 68
Acid, hydrofluoric, manufacture 197
Acids of fruits 195
Acorns, do birds eat? 7
Aerolite, fall of 391
Aerolites, fall of 325
Aeronautical congress 183
Africa, exploration in 355
Agami or trumpeter *314
Age, stone, Tasmania 293
Agriculture, notes on 195
Air, foul, of wells 356
Air, luminous 262
Air, solid 345
Alcohol from paper 18
Alfalfa crop 25
Alkalies, action on glass 43
Aluminum 58
Aluminum, distribution of 217
Aluminum light 283
Aluminum, solder for 213, 309
Americans a practical people? 342
Amidol developer, formula 51
Animal sounds 276
Annunciator, fever 393
Anticholerin of Klebs 85
Antiseptic, cinnamon as 53
Ants breeding in and in 282
Ants, do they talk? 377
Ants in Africa 6
Arbor press, Greenerd *245
Architects, rare chance for 242
Arctic regions life in 359
Arethuse, torpedo cruiser 262
Arizona, irrigation in 292
Armadillos *74
Armor plate, American, trial 83
Armor plate, Harveyized 163
Armor plate trust 210
Armor plates, remarkable 198
Armor plates, tempering 186
Armour Institute 178
Armour Institute, Chicago 3
Arms, small, manufacture 22
Army, railroad, our 139
Arrowroot plantations 86
Arrowroot manufacture 315
Art, aid to, photography 392
Asbestos porcelain 100
Aspirator, improved 277
Assal, Lake 183
Atlantic sea bed 87
Atmosphere, pressure *102
Atmosphere, submarine 283
Auger, square hole 133
Awning, window, Branner *164
Axle box, car, improved *196
Axles, steel 104

B

Balloon line, trolley 179
Balloon, military, great 72
Baltimore, cruiser, in dry dock 216
Bananas and potatoes 135
Bancroft, cruiser, plans for 215
Bank, Commercial National 354
Barge, pleasure, for a prince 356
Barrels, steel 292
Battle ship, great, launch 151
Battleship Iowa *153
Beams, pine, shrinkage 261
Beds, attachment for *213
Beer, boric acid in 120
Belt, electric *277
Belt guide and tightener *52
Belt tightener *36
Belting 75
Bering sea controversy 346
Bicyle industry *180
Bicycle, Jenkins' *69
Bicycle, Lovell *117
Bicycle, Mail, safety *245
Bicycle stand *388
Bicycle, the 122
Bicycles vs. tricycles 266
Bicycling, military 54
Bicycling tour, remarkable 91
Binder, shock, Unruh's *133
Bird, cage, club 323
Birds that nest in cavities *218
Bit brace ring *277
Blasting, submarine 356
Blistering paint 393
Boards, trunk and bookbinders' *10
Boat, life, inventor of 310
Boat, petroleum *340
Boats, ferry, double deck 342
Boats, torpedo, fast 23
Boiler furnace, Richard's *229
Boiler preservation 310
Boiler, steam, Hise's *69
Boilers for cruiser Cincinnati *216
Boilers, horse power of 11
Boilers of kitchen ranges 195
Book holder, Gardinier's *181
Borax mine, a 343
Borer, hickory bark *148
Boring tool, Cutting's *261
Borings in Broadway, New York 217
Boron 154
Boston harbor improvements *167
Bottles, leathern *308
Bottles, milk, airtight 324
Boys and labor, American 293
Brace, bit, Knudsen's *20
Bracket for miners' lamps *181
Brakes, automatic 42
Brakes, new law for 162
Brass coloring 354
Bread kneader, Stone's *4
Breakfast service, novel 183
Bricks, fire, magnesia 374
Bricks, sawdust 315
Bridge, Germany's highest *379
Bridge, Garibaldi, Rome *150
Bridge moved by rail *193
Bridge, Pecos River *87
Bridges and "L" connections *245
Bronze powder, how made 276
Brushes, dynamo, sparking of 166
Bubbles, soap, experiments with *266
Buckle, Aylsworth's *196
Building associations, New Jersey 18
Building, Columbus, Chicago 374
Building, cyclone *4
Burner, crude oil *181
Button, pearl, industry *260

C

Cable railway, Broadway, N. Y. *249
Cable railway, New York *305
Cable road, accident on 341
Cable roads of New York 34
Cable, street car, laying of 194
Cable traction, New York 370
Cage bird club 323
Calking tool, Walton's *310
Camera lucida, improved *196
Campania, fast time of 307
Campania, steamship *155
Canal, Erie, celebration of 1825 371
Canal, Nicaragua 146
Canal, Panama and Lesseps 234
Canal, proposed 54
Canals, Panama and Nicaragua 119
Candy without cooking 133
Canned food, effects temp 325
Canned food industry *296
Cannonades for rain making 242
Cans, tin, utilization *186
Car attachment, Henthorne's *325
Car axle box, improved *196
Car couplers, new law for 162
Car couplers, test of 308
Car coupling, Smith's *213
Car coupling, Vogt's *230
Car, mine, Durand's *180
Car motor, Connelly 266
Car, passenger, Tillson's *101
Car, sleeping, Sneckner's *213
Car window holder *345
Caravel, Columbus', model 91
Cardine, new heart tonic 298
Carriage indicator, Blake's *361
Carriage tops, etc., care of 198
Carts, mule, prizes for 167
Cascara sagrada, elixir of 119
Casket, Shaksperian *372
Cats, performing *72
Cattle group, World's Fair *259
Cave, marble, of Missouri *65
Celestial investigation 340
Cells, storage, for amateurs *134
Celluloid, dangers of 39
Cement for steam packing 379
Cement for wood and glass 279
Cement, Portland, Forell's 6
Centenarian, a lively 245
Cerium salts in photography 324
Chair and desk, adjustable *20
Chairs, rocking, electric *276
Chairs, rolling, at the Fair *371
Chemical action, stoppage 297
Chemical notes 186
Chemistry, econo. wrought by 388
Chestnut worm 55
Chicago, another wonder for 247
Chicago enterprise 389
Chicago, warship 52
Chimney struck by lightning *69
Chimneys, highest 59
Chinese, discoveries of 374
Chinese, exclusion of 66
Chinese, heathen 265
Chloroform, solidified 134
Cholera, extermination of 338
Christopher Columbus, steamer *297
Chromium 23
Chromium by electrolysis 36
Chuck, lathe, independent *196
Cincinnati, boilers for the *216
Cinnamon as an antiseptic 53
City, golden, in Africa 34
Climate of Japan, influence 26
Climates, Colorado 116
Clock, electric *373
Clock for America *372
Clothes drying frame *342
Coach, railway, Tillson's *101
Coal dust, utilization 283
Coal spontaneous combustion 90
Coal used on war vessels 35
Coal washer, improved *20
Cobalt plating 121
Codman, Henry S 102
Coins, counterfeit, perfect 343
Coins, trick with *276
Cold and ether 59
Cold, how to cure 134
Cold, resistance to 170
College, Sibley, new building for 378
Colon, Cristobal *244
Colorado climates 116
Columbian Exposition notes 387
Columbus, a pharmacal 102
Columbus building, Chicago 374
Columbus celebration, N. Y. *264
Columbus expedition, cost 283
Columbus' squadron *264
Columbus' ships, coming of 2
Commerce, foreign, of the U. S 84
Commerce, ocean, American 130
Compact bodies, weight of 198
Composition paint 392
Conduit electric railway *356
Congress, aeronautical 183
Congress, world's auxiliary 178
Consumption, contagiousness 373
Conveyer, Tench's *20
Cooking vessel *36
Copper on birds' feathers 169
Copper on prints 185
Copy holder, Gardinier's *181
Corn husks, paper from 232
Correspondence, secret 25
Cotton picker, pneumatic *361
Cotton seed, sugar from 181
Coupling, car, Smith's *213
Coupling, car, Vogt's *230
Couplers, car, new law for 162
Couplers, car, test of 308
Crane, traveling *298
Cranes, traveling, new *353
Crankshaping machine *180
Cremation, modern 120
Crucible, electric *292
Cruisers, armed, advance in 55
Cruiser Baltimore in dry dock *216
Cruiser Bancroft, plans for 215
Cruiser Cincinnati, boilers for *216
Cruiser Maine, progress of *185
Cruiser New York 211
Cruiser Pamyat Azova *265
Cruiser, torpedo, Arethuse 262
Cruiser Vesuvius, trial of *88
Curious tree growth *390
Current, earth, strange effects 230
Current, electric, maximum 199
Curry, S. S., steamer 370
Curves, magnetic, photographing 39
Cutting-off machine *5
Cycle, Lovell *117
Cycling, military 54
Cyclone building *4
Cylinder, steam, large, casting *145

D

Day, length of the 250
Decision, important 170
Delftware 184
Desert, Colorado 34
Desk attachment, Neff's *389
Developer, amidol, formula 51
Developer, new 26
Development, photo., elect. art 59
Device, vessel stopping *388
Diamond in meteoric iron 87
Diamonds at the Fair 361
Dinosaurs, gigantic *137, *138
Dicovery, always room for 345
Discovery—invention 19
Disease from unclean money 50
Divider, instantaneous 325
Dollars, silver, counterfeit 343
Dough kneader *4
Douglass, Frederick, career 295
Dredger, largest in world 311
Drill, air, Wilderman *101
Drowning, rescue from *360
Dry plate photography, gelatine 146
Dulcine 4
Dumbwaiter, Larsen's *229
Dumbwaiter shafts 379

© 1893 SCIENTIFIC AMERICAN, INC

Dust and sand figures.....*202
Dust explosion, remarkable.....313
Drying frame, clothes.....*342
Dyeing wood, zinc in.....242
Dyestuffs, new.....354
Dynamite, manufacture of.....*132
Dynamo brushes, sparking.....166
Dynamo engine, Corliss.....*200

E

Earth, age of.....232
Earthquake in Greece.....104
Earthquake of March 8.....165
Eclipse, solar, April 16.....*262
Economies wrought by chem.....388
Economy gas or electricity.....390
Edison when young.....210
Effigies, intaglio, Wisconsin.....*390
Egg puzzle, Columbian.....*281
Electric rules, underwriters'.....372
Electric systems at the fair.....290
Electricity and country roads.....231
Electricity and light, identity.....279
Electricity at Fair opening.....357
Electricity at the Exposition.....226
Electricity generating, new artof *99
Electricity in surgery.....69
Elevated railway, Naples.....389
Elevator shifting device.....*117
Elevator, Tench's.....*20
Elevators, shifting device for...*117
Elixir of cascara sagrada.....119
Elms, twin.....*356
El Nueve de Julio, ship.....*264
El Rio, steamer.....*202
Elrie, steamer, accident to.....*116
Engine and dynamo, simple.....325
Engine, dynamo, Corliss.....*200
Engine, gas, Biggar's.....*133
Engine, gas, made noiseless.....25
Engine, hoisting, Bacon's.....*341
Engine, traction, Stratton's.....*185
Engine, traction, Stout's.....*117
Engine, triple expansion.....338
Engines, petroleum, at the Fair. *340
Engineers, Civil, Amer. Society..50
Engineers needed in navy.....53
Engineering build., Pa. College.*214
Engineering, electrical.....322
Engineering in Mexico.....362
Enterprise, Chicago.....389
Entomologists, noted, two.....151
Erie Canal celebration of 1825....371
Erosion, recent, in Indiana.....*152
Esparto grass.....115
Etching on copper, half-tone....83
Ether and cold.....59
Europe and U. S. in 1893.....315
Evaporator, triple effect.....*228
Exploration, African.....355
Exposition at Lyons.....*388
Exposition, Chicago.....*138
Exposition, Columbian. 67, 103, 115, 163, 179, 227, 243, *258
Exposition, Columbian, awards..322
Exposition, Columbian, notes 199, 211, 307, 323, 339, 355, 371, 291
Exposition, Columbian, opening. *274, 290
Exposition, Columbian, prices..306
Exposition, electricity at the...226
Exposition entrances.....*168
Exposition, hygiene at.....147
Exposition Japanese at.....*392
Exposition, photography at.....354
Eye and telescope.....41

F

Factory driving, electrical.....*200
Facts, interesting.....330
Fair buildings, entrances.....*168
Fair, World's.....227, *258, 243
Fair, World's, awards at.....322
Fair, World's, Chicago...103, 115, *138
Fair, World's, cost of.....281
Fair, World's, electricity at.....226
Fair, World's, notes.....39, 51, 67, 163 199, 211, 307, 323, 339, 355, 371, 291
Fair, World's, opening of..*274, 290, 291
Fair, World's, painting machine.*257
Fair, World's, prices at.....306
Fair, World's, progress.....34
Fair, World's, Virginia at.....135
Fall of aerolite.....391
Family relations in Japan.....361
Farm changes in Illinois.....370
Farmer, Moses G.....338
Feathers and lightning.....359
Feathers, copper on.....169
Feed water regulator.....*261
Feet of Chinese women.....54
Fence wire stretcher.....*149
Ferryboats, double deck.....342
Festivities, naval, Columbian...*273
Fever annunciator.....393
Fever, scarlet, remedy.....281
Fiber from dwarf palm.....322
Files, American, quality of.....102
Files, American vs. foreign.....19, 71
Filter, water, germ proof.....*214
Filters, inexpensive (5,000).....*300
Fire, a peculiar.....118
Fire apparatus, improved.....*85
Fire bricks, magnesia.....374
Fire escape, Bruce's.....*101
Fire jets.....359
Fire protection for ironwork.....*229
Fire service of New York.....186
Fires, curious examples of.....242
Fires, how some originate.....150
Fires, how they affect people.....147
Fireworks in miniature.....*40
Fish, frozen, transportation.....263
Flags, cut-tail.....89
Flames, separation of.....313
Floors, plaster of Paris.....71
Flour mill, the largest.....359
Flower trick.....*36
Flowers, perfume in.....73
Flowers, perfumes of.....357
Flying machine, Langley's.....*246
Flying machine, Phillips'.....307
Focusing device for telescopes..*344
Fog signal, siren as.....182
Fontainebleau proving grounds..*106
Food, canned.....*296
Foods, canned, effects heat.....325
Forgery, detected by chemistry..38
Foundations, concrete.....*248
Foundations, engine, elastic.....43
Foundry experience, unusual.....118
Fountain at Vienna.....*217
Fountains, luminous.....*52
Fox dogs, Siberian.....*123
France, statue.....*358
Francis, Joseph.....310
Frost on window panes.....39
Fruits, acids of.....195
Fuel, oil, at the fair.....89
Fulton, name for war steamer...*226
Fungus, luminous.....66
Furnace, boiler, Lawton's.....*245
Furnace, high temperature.....83
Furnaces, electric.....*292
Furniture, artistic.....*524

G

Galveston, water supply.....346
Garibaldi bridge, Rome.....*150
Gas engine, Biggar's.....*133
Gas engine made noiseless..25
Gas light, incandescent.....311
Gas, natural, decadence.....3
Gas, natural, Geneva, N. Y.....130
Gas or electricity, economy.....390
Gas pipes, dangers from.....377
Gas supply for New York.....*119
Gas well, peculiar.....7
Gases, compressed, medical uses. 2
Gases, moisture in.....7
Gate worker, automatic.....*73
Gauges, water, valve for.....*101
Geissler tubes, to make.....230
Glacial period.....86, 103
Glass, action of alkalies on.....43
Glass, plate, industry, Austrian..250
Glass, to bore holes in.....279
Glue, waterproof.....11
Glycin.....26
Gold and silver, recovery of.....*169
Goldsmiths' work, English.....*372
Gospels, early texts of.....*346
Grass, esparto.....115
Green, Dr. Norvin.....115
Greenland, North.....71
Gun, rapid fire, navy.....*376
Gun, wire.....261
Guns, great, Turkish.....313
Guns, Krupp, for Chicago.....*228
Guns, wire-wound.....311

H

Hailstones, dangerous.....58
Hall, Machinery, Chicago.....35
Hamburg, streets in.....39
Hammer, steam, 100-ton.....*362
Harbor defender Katahdin.....*97
Harbor improvements, Boston...*167
Harness, polish.....229
Harrow, an improved.....*197
Haswell, Charles H.....170
Hawaiian Islands, annexation.....*82
Hay stacker, Allen's.....*324
Heart tonic, new.....298
Heat lost through wind.....10
Heat storage.....83
Heater, electric, for cars.....*198
Hecla, broken shaft of.....*345
Hemerograph, Blain's.....*196
Hickory carved by worms.....*148
Hoisting engine, Bacon's.....*341
Honey, crystallization of.....215
Horseshoe sharpener.....*85
Horsford, Prof. E. N.....23
House moving, feat in.....*91
Hybrids, strange.....*123
Hydraulic wheel press.....*389
Hydrotype, the.....50
Hygiene at the Exposition...*147
Hygroscope, simple.....*309
Hypnotic, trional as.....371

I

Ibex kids.....*123
Ice, artificial, for skating.....*11
Icebergs, gigantic.....326
Ice crop, Hudson River.....36
Ice crusher and war steamer.....55
Ice in the subway.....*152
Ice, molecules of.....84
Ignition tubes, earthen.....360
Illinois, farm changes in.....370
Impressions in sulphur.....151
Improved pinch bar.....*388
Improved models, harbor.....*391
Improved road gate.....*389
Indiana, launch of.....151
India rubber, good vulcanized...118
Indicator, carriage, Blake's.....*361
Induction coil, alt. currents.....199
Induction coil, new.....*149
Ink monopoly.....25
Insects, instinct of.....*39
Insects, number of, in world.....282
Institute, Armour, Chicago.....3, 178
Institute, Brooklyn.....18
Institute of Technology, Mass...155
Instruments, musical, oldest....*197
Insurance, life.....292
Intaglio effigies, Wisconsin.....*390
Intensifier for negatives.....42
Intestine, rupture of.....182
Invention—discovery.....19
Invention, new, wanted.....186
Inventions, recently patented..12, 28, 44, 60, 76, 92, 108, 124, 140, 156, 171, 187, 203, 219, 235, 251, 267, 284, 298, 315, 330, 346, 363, 380, 394
Inventor, American.....247
Inventors and manufacturers....135
Inventors, advice to.....370
Inventors, chance for.....19
Inventors, successful.....169
Iowa, battle ship.....*153
Irrigation in Arizona.....292
Iron, pig, lifting.....199, 246
Iron, preservation from rust.....10
Iron, sheet, trust, German.....377
Iron structures, cooling.....*229
Ivy poison, remedy for.....375

J

Japan, climate, influence of.....26
Japanese at Exposition.....*392
Jets, fire.....359
Jetties on Brazos River.....*41
Jetties, New Orleans.....373
Jeweler's sweepings.....*169
Journey, snow, long.....323
Jupiter and his satellites.....359

K

Kangaroo as prize fighter.....*25
Katahdin, ram.....*97
Kinetograph, Edison's.....310
Knife grinder, automatic.....*213
Knife, Nubian.....*390
Krupp exhibits, Chicago....*228, *244
Kurfurst Friedrich Wilhelm.....*264

L

Ladder and truck, improved.....*375
Labels on glass, porcelain, etc...122
Labor troubles in England.....104
La France, statue.....*358
Lake, salt, of Assal.....183
Lamination in metal.....278
Lamp, electric, improved.....375
Lamp patent, Edison, attacked. 82
Lamps, miners', support.....*181
Lanern projections, slides for..20
Language, English spread of.....275
Lantern, electric light.....*373
Lantern slide changer.....*212
Lantern slide coloring.....*153
Lantern slides, varnish for.....166
Lantern slides, viewing.....*40
Largest cave.....390
Lathe check, independent.....*196
Launch battleship Massachusetts 386
Launch of the Indiana.....151
Launches, end-on.....25
Laundry, steam, modern.....*23
Lead poisoning, prevention.....20
Leather bottles, manufacture...*308
Leather, color printing on.....245
Letter boxes, street car.....295
Letter express delivery.....27
Leveling instrument, Merrill's..*245
Library, Brooklyn.....214
Library, Lenox.....247
Library mutilators.....196
Life boat, inventor of.....310
Life guard, car.....*325
Life insurance.....292
Life saving exhibit at Fair.....355
Life wheel, Buddhist.....375
Light, aluminum.....283
Light and electricity, identity....279
Light, electro-mechanical.....296
Light, gas, incandescent.....311
Light, magnesium.....38
Light, refraction and dispersion.*392
Lights, incandescent.....262
Lighter, wax, magic.....*325
Lighthouse, Cape Hatteras.....340
Lightning, electric, of Rome.....121
Lithia waters.....130
Lock, sash, Kirby's.....*345
Locomotive 999.....*341, 378
Locomotive, beautiful model.....167
Locomotive cab seat.....*36
Locomotive, English, large.....*212
Locomotive, express, Winby's..*321
Locomotive, gas, Biggar's.....*133
Locomotive, monster.....*135
Locomotive sparks, law as to.....194
Locomotive, the engineers'.....*281
Locomotive valve.....*165
Locomotives of 1831 and 1893.....*294
Lost people walk in circles.....100
Lunatics, commitment of.....116
Lur, the.....246
Lyons Exposition.....*388

M

Macaroni, manufacture of.....*329
Machinery Hall, Chicago.....35
Machinery, old, discard it.....277
Magnesia fire bricks.....374
Magnesium light.....38
Magnesium zinc-eisen.....231
Magnetic screens.....297
Mail distrib., street car.....10
Mails burned.....72
Mails under American flag.....22
Maine, cruiser, progress.....*185
Maine, motive power in.....43
Man, the steam.....*233
Manger, Vender's.....*55
Mangle, Hagen.....*357
Maple sugar, artificial.....116
Marble cave of Missouri.....*65
Marble, photography on.....357
Mars, signaling.....183
Massachusetts, battleship, launch 386
Matches, safety, danger.....102
Mauna Loa, eruption of.....263
Mauna Loa, volcano.....*121
Mutton, frozen, industry.....330
Measuring and drawing tool.....*309
Mechanism, beautiful spec.....167
Mesmerism, the new.....117
Metal, lamination in.....278
Metals, physical properties.....230
Meteor, remarkable.....226
Meteors of Nov., 1892.....4
Meteorite, fall of, Dakota.....19
Meter, water, Woollen's.....*324
Miantonomoh, monitor.....*330
Microphone patent, Berliner.....114
Mikado, new toy.....*72
Milk bottles, airtight.....324
Milky way, stars of the.....359
Mill, rolling, large.....*361
Millstone, vertical, Mantey's.....*53
Millstones, rock emery.....295
Mine car, Durand's.....*180
Mining district, Guanajuato.....313
Mixer, quick delivery.....*295
Molasses, utilization of.....213
Money maker.....*84
Money, unclean, causes disease. 50
Monitor Miantonomoh.....*330
Monitor Terror.....*133
Monsters, extinct.....*137
Mosaics for the Fair.....261
Mosquito exterminator.....325
Motor, car, Connelly.....266
Motor, gas, made noiseless.....25
Motor, Havline's.....*184
Motor, heat, novel.....*182
Motor, light and simple.....*85
Motors, petroleum, at the Fair...*340
Mule carts, prizes for.....167
Mumps, period of infection.....278
Music as a remedy.....42
Musk ox, note on.....152

N

Naphthalene preservative.....391
Natural history notes.....282
Naturalists, eight young.....147
Naval service, coming.....147, 242
Navigation, aerial.....179
Navigation, lake, steam.....138
Needles, how made.....27
Neff's desk attachment.....*389
New station, Philadelphia.....392
Newspapers, daily, American.....242
N. Y. harbor improvem't models.*391
New York, steamer.....*136
New York, warship.....211, *375
New York, warship, trial.....338
Nicaragua canal.....119, 46
Nickel.....71
Niepce, not Daguerre.....42
Nile, sources of.....166
Nitrogen, free, fixation.....282
Nitroglycerine, not to freeze.....71
Notes from Columbian Exposit'n 387
Nubian knife.....*390
Numbering machine, Bates'.....*247

O

Oak, poison, remedy for.....375
Oak, to darken.....73
Oil and gas in Ohio.....38
Oil, cotton seed, soap from.....50
Oil, crude, burner for.....*181
Oil fuel at the fair.....89
Oil vs. coal.....134
Ointment, mercurial.....89
Okefinokee swamp, draining.....179
Old and new ships.....386
Omnibus with pneumatic tires...146
Orchids, fertilization of.....282
Osmium, liquefaction of.....312
Ostrich farming, American.....3
Ox, musk, note on.....152
Oxygen, liquid.....279
Oyster grounds, South Carolina..*121

P

Packing, steam, cement for.....379
Pains in the heart region.....72
Paint blistering.....393
Paint, composition.....392
Paint for racers.....212
Painting machines, World's Fair.*257
Pallograph, the.....344
Pamyat Azova, cruiser.....*365
Panama Canal.....119
Panama Canal and Lesseps.....234
Panthe on, chronology of, new...7
Paper, antiseptic.....128
Paper from corn husks.....232
Paper, straw, how made.....378
Paracelsus, quadricentennial of..102
Parade, naval, and review.....*273
Parades, illuminating.....105
Paste for labels on glass, etc.....122
Paste for paper and glass.....71
Pasteur, honor to.....74
Patent, Berliner.....162
Patent bill, a bad.....66
Patent cases, equity in.....90
Patent decision, important.....211
Patent, microphone, Berliner.....114
Patent Office, Canadian.....274
Patent, value of a.....178
Patents, Commissioner, report..98
Patents, Commissioner of, new..211
Patents, decisions relating to..42, 87, 122, 131, 167, 183, 215, 250, 278, 326
Pavements, city.....102
Pearl button industry.....*260
Pecos River bridge.....*87
Pedal attachment, organ.....*52
Pendulum, compensation.....*151
Pennsylvania Co.'s new station..392
Perfume in flowers.....73
Perfumes of flowers.....357
Petch's plow attachment.....*389
Petroleum engines at the Fair...*340
Phonograph, photography of.....360
Phonograph, the Pope and.....229
Phonographic message, Pope's..308
Phosphate washer, Beaty's.....*164
Phosphates, hard and soft.....131
Photograph, to print on marble..247
Photographic notes.....42
Photographing by bin'x. nitrog..23
Photographs in colors.....378
Photography, aid to art.....392
Photography at the Exposition.354
Photography, automatic.....*170
Photography, gelatine dry plate.146
Photography in colors.....329
Photography, instantaneous.....*330
Photography, meteoric.....58
Photography of the phonograph.360
Photography on marble.....357
Photography on wood.....86
Photography, recreations in.....*184
Photography to art, relation of..386
Photo-opera glass.....*248
Photo plates, sensitive.....74
Phthisis, contagiousness of.....373
Pianos, stringing.....*214
Pichiciago, the.....*75
Pigeons, carrier.....326
Pillows, wire, torsion braided...*375
Pinch bar, improved.....*388
Piperazine.....230
Pipes, frozen, to thaw.....150
Piping of dwellings.....138
Planets, positions of in April.....195
Planets, positions of in February 74
Planets, positions of in June.....343
Planets, positions of in March...131
Planets, positions of in May.....263
Planter, potato, Sturdy's.....342
Plants, starch in.....282
Plaster of Paris floors.....71
Plates, fogged, recovering.....42
Plating, cobalt.....121
Platinum prints in sepia.....378
Plow attachment, Petch's.....*389
Plows, snow, in Roumania.....166
Pneumatone, Mudge's.....*36
Pneumatic tube service.....90
Pocket, safety.....*357
Poisoning, presence of mind in..341
Polecat, hunting the.....218
Polish, harness.....229
Pollen, coloring matter.....282
Pontoons, steel.....230
Pope and the phonograph.....229
Pope, phonographic message....*308
Porcelain, asbestos.....100
Post office, Baltimore.....*346
Post office of the Fair.....291
Potato planter, Sturdy's.....*342
Potato scab, prevention of.....274
Potatoes and bananas.....135
Power, transmission, Edison's..*296
Preservative, timber.....391
Press, arbor, Greenerd.....*245
Press, steam, hydraulic.....*330
Prestidigitation.....*276
Printing on leather.....245
Printing on silk.....42
Prints, blue, conversion.....42
Prints, blue, browning.....291
Prints, copper on.....185
Prints, platinum in sepia.....378
Prison construction, improved..*209
Projectiles, modern.....371
Propulsion, electric tramway...358
Propulsion, hydraul., of vessels.*277
Proving grounds, Fontainebleau*106
Pulp, wood.....154
Puzzle, egg, Columbian.....*281
Pygmies from Africa.....282
Pyroxylin, explosion of.....312

R

Rabbits, climbing.....282
Racquet and Tennis Club, N. Y..*232
Rafts, military.....*308
Radiation through vacua.....118
Railroad army, our.....139
Railroad employes, legal status..191
Rails, steel, very cheap.....388
Rails, street car, cleaning.....379
Rails, testing.....393
Rails, welding the ends.....341
Railway block signal.....*214
Railway, cable, Broadway, N. Y..*249
Railway, cable, New York...*305, 370
Railway coach, Tillson's.....*101
Railway, elevated, electric.....*40
Railway, elect., Chicago & St. L.*328
Railway, electric, conduit.....*356
Railway, electric trolley.....306
Railway, elevated, Naples.....389
Railway exhibit, English.....212
Railway, intercontinental, map..232
Railway, overhead propelled.....*53
Railway roadbed, improved.....*262
Railway speed, high.....306
Railway tie, metallic.....*373
Railways, agricultural.....210
Railways, electric, progress.....114
Railways, elevated, additions....50
Railways, elevated, traffic of.....18
Railways, street, steam.....178
Rain making, cannonades for....242
Rain making, suggestion on.....247
Recess boring tool.....*261
Refraction and dispersion, light.*392
Regulator, feed water.....*261
Relation of photography to art...386
Review, naval, Columbian.....*273
Review, naval, coming.....147, 242
Rhus poisoning, cure for.....375
Rice, census returns of.....312
Rifle, magazine, new, U. S.....226
Rifles, magazine, tests.....168
Ring, bit brace.....*277
Rain Katahdin.....*97
Roadbed, railway.....*292
Road gate, improved.....*389
Road hardener wanted.....263
Roads, country, and elect'y..231, 311
Rome, electric lighting of.....121
Roofs, leaky, Chicago.....199
Rubber toys, improved.....*197
Ruric, warship.....*37
Ruthenium rod.....342

S

Saddle attachment.....*261
Salt lake of Assal.....183
Sand and dust figures.....*202
Sandstone quarries, Potsdam.....*8
Santa Maria, Nina, and Pinta....*265
Sash lock, Kirby's.....*345
Sausage casings holder.....*247
Sawdust bricks.....315
Saw guide, improved.....*149
Saw, stone, diamond toothed.....230
Saws, steam engine.....178
Scaffold truss.....*277
Scale, universal.....*182
Science, modern, conquests.....295
Scorpion, deadly.....*283
Screens, magnetic.....297
Screw drivers, labor-saving.....*118
Screw, swedged.....215
Scum, green.....151
Sea bed of Atlantic.....87
Seat, locomotive cab.....*36
Seeds, sorrel, antisporadic.....282
Shaft of the Hecla, break.....*345
Shaft of Umbria, repair..*24, *56, *84
Shafts, dumbwaiter.....379
Shafts, wire for steamers.....122
Sharpener, horseshoe.....*85
Sheet iron trust, German.....377
Shield, Columbian.....*372
Ship, Indiana, launch of.....151
Ship, Viking.....*309
Ship, Viking, Exposition.....*393
Ship of war Chicago.....52
Ship of war El Nueve de Julio...*264
Ship of war, German.....*264
Ship of war Iowa.....*153
Ship of war Maine.....*185
Ship of war New York.....211, *375
Ship of war New York, trial.....338
Ship of war, Pamyat Azova.....*265
Ship of war Terror.....*183
Ships, Columbus', coming of.....2
Ships of war, speed of.....338
Ships, old and new.....386
Ships, old, breaking up.....170
Shock binder, Unruh's.....*133
Shoe, snow.....135
Shops, to free from steam.....106
Siemens, Dr. Werner Von.....*21
Signal, block, railway.....*214
Signaling apparatus, electric.....*5
Signaling Mars.....183
Silk, artificial.....210
Silk industry, American.....147
Silk of spiders.....107
Silks, cold storage for.....85
Silver mining.....354
Simplon, tunneling through.....118
Siren as a fog signal.....182
Skating rink, Paris.....*11
Sketching apparatus.....*73
Skunk, hunting the.....218
Sleepers, metal, for railways.....84
Sleighs, variety in.....*37
Slide changer and eclipser.....*212
Slides for lantern projections.....20
Smelting and casting, electric....279
Smithsonian Instit. prizes.....250
Snow, density, cause of.....279
Snow journey, long.....323
Snow plows, in Roumania.....166
Snow shoe exercises.....*73
Snow shoe, the.....135
Soap bubble experiments.....*266
Soap, cotton seed oil.....50
Sodium peroxide.....137
Sodium silicate, uses of.....342
Solder for aluminum.....213, 309
Sound.....378
Sound waves, demonstration.....374
Sounds, animal.....276
Speaking tube.....*6
Spider, trap door.....166
Spiders, distribution.....282
Spiders, silk of.....107
Sprinkler, automatic.....*261
Sprocket, elliptical.....199
Stainton, H. T.....151
Stand, bicycle.....*388
Star search, aids for.....72
Starch in plants.....282
Stars of the Milky Way.....359
Steam engine saws.....178
Steam, King.....118
Steam packing, cement for.....379
Steam power from house dust...43
Steam pressure recorder.....*295
Steamboat travel, safety of.....134
Steamer Christopher Columbus..*297
Steamer Elrie, accident to.....*116
Steamer El Rio.....*202
Steamer, lake, the largest.....370
Steamer New York.....*136
Steamer, war, first, launch of....*233
Steamers, Atlantic.....42
Steamers, Cunard, dimensions...35
Steamers, great, two new.....313
Steamers, lake, large.....53
Steamers, safety suggestions...2, 55
Steamers, tramp, economy of....55
Steamers, vibrations of.....344
Steamship Campania.....*155
Steel, preserv. from rust.....10
Steel rails very cheap.....388
Stone age in Tasmania.....293
Stone breaker, Austin's.....*165
Stone, meteoric, Dakota.....154
Stone saw, diamond toothed....230
Storage cells for amateurs.....*134
Storage, cold, for silks.....85
Storage, thermal.....83
Stream, an underground.....194
Street car rails cleaning.....379
Stretcher, fence wire.....*149
Strip, the electrician.....*293
Structures, iron, cooling.....*229
Subway, ice in the.....*152
Sugar, census returns of.....312
Sugar from coffee seed.....181
Sugar industry in Cuba.....*104
Sugar, maple, artificial.....116
Suicide, causes of.....169
Sulphur, impressions in.....*53
Sumach, poisonous, remedy for..375
Sundials, modern.....*148
Swamp, Okefinokee, draining....179
Sweden, tax problem of.....51
Sweepings, jewelers', gold from.*169
Switch device.....373

T

Table, extension, improved.....*134
Tanning by electricity.....357
Tapestry, Gobelins.....66
Tasmania, stone age.....293
Tax problem in Sweden.....51
Technology, Institute, Mass.....155
Telautograph.....*198
Telegraph decision.....358
Telegraph, inventors of.....58
Telegraph, printing, Equitable..*99
Telephone, achievements.....98
Telephone, Berliner patent.....162
Telephone Co., Bell, answer.....339
Telephone patent, Bell.....278
Telephone patents, Bell.....178
Telephone suit, important.....170
Telephony, long distance.....*98
Telephotos, Boughton's.....*5
Telescope, gigantic, proposed....103
Telescope, naval observatory....182
Telescope, 40-inch, Yerkes.....10
Telescopes, focusing device for..*344
Tellurian, Dunham's.....*197
Temperature north and south.....185
Temperature, underground.....343
Tennis and Racquet Club, N. Y..*232
Terms of water measurement.....327
Terrier, the electrical.....*293
Test, chemical, a delicate.....146
Testing 100 pound rails.....393
That is so.....169
Thermometers, systems of.....358
Thought, habits of.....326
Tie, railway, metallic.....*373
Tie-dog for rails.....*276
Tigers, ravages of.....377
Tile, side and roofing.....*4
Timber test work, U. S.....283
Time system, electric.....*373
Tin cans, utilization.....*186
Tin from scrap.....327
Tin, metallic, on cloth.....211
Tin, where from.....391
To be happy, be reasonable.....376
Tomlinson, Lawrence.....*59
Tool for watchmakers.....*6
Torpedo boats, fast.....23
Torpedo cruiser Arethuse.....262
Torpedo cruiser Vesuvius.....*88
Terror, warship.....*188
Toy, a novel.....*72
Toys, rubber, improved.....*197
Traction engine, Stratton's.....*185
Traction engine, Stout's.....*117
Train, fast, to Chicago.....311
Transportation, improved.....370
Travel, steamboat, safety of.....135
Traveling in America, former.....26
Tree growth, curious.....*290
Tree growths, curious.....*293, 343
Trees, age told by rings.....311
Trees, Australian.....217
Trick with flowers.....*36
Tricks in prestidigitation.....*276
Trional as a hypnotic.....371
Trolling with live fish bait.....*71
Trolley balance line.....179
Trolley electric railway.....306
Trolley systems, dangers from...377
Trumpeters, the.....*314
Trunk and bookbinders' boards..*10
Truss, scaffold.....*277
Tubes, tin lined, defects in.....41
Tunnel, submarine 8-mile.....6
Tusk, a mammoth.....244
Typewriter wanted.....358
Typewriters, National.....*27

U

Umbria, shaft of, repair.....*24, *56
Umbria, shaft of, repaired.....*84
Unicycle, Imlah's.....*260
United States and Europe.....315

V

Valve for water gauges.....*101
Valves, locomotive, Kinney.....*165
Valve suction, Brenner's.....*229
Varnish for lantern slides.....166
Veragua, Duke of.....*244
Vessel, jet-propelled.....*277
Vessel stopping device.....*388
Vessels, sunken, how raised.....*166
Vesuvius, cruiser, trial.....*88
Victoria Building, Chicago.....*68
Vienna and China juxtaposed...*372
Viking ship.....*309
Viking ship, Exposition.....*393
Vipers Ceylon.....122
Virginia at the World's Fair.....135
Vision, persistence of.....*43, *215
Volcano Mauna Loa, activity....263
Volcano of Mauna Loa.....*124
Volcanoes, Mexican, activity....67

W

Walls, hollow, advantages.....155
Warship Chicago.....52
Warship El Nueve de Julio.....*264
Warship, German.....*264
Warship Iowa.....*153
Warship New York.....211, *375
Warship New York, trial.....338
Warship Maine, progress.....*185
Warship Pamyat Azova.....*265
Warship Ruric.....*37
Warship Terror.....*183
Warships, speed of.....338
War steamer, first, launch.....*233
War vessels, coal used on.....35
Washer, drier and separator.....*356
Washer, phosphate, Beaty's.....*164
Water cooler.....*214
Water gate, Norton's.....*21
Water gauges, valve for.....*101
Water, hot, distribution of.....*120
Water jet.....59
Water jet propuls. for steamers 71
Water jet propulsion.....*277
Water level recorder.....*295
Water main, a foul.....327
Water mains, vegetab. growth in 67
Water measurement terms of....327
Water meter, Woolen's.....*324
Water motor, Partridge's.....*22
Water purifier, citric acid as....68
Water supply of Galveston.....346
Water, to freeze on small scale..67
Waves, electric, stationary.....198
Waves, sound, demonstration....374
Wax lighter, magic.....*325
Weeds as large as trees.....282
Weight that a man can handle...135
Welding, electric, effects.....51
Well, phenomenal.....87
Wells, breathing.....19
Wells, foul air from.....356
Westwood, John O.....151
Wheat crop.....54
Wheel of life, Buddhist.....375
Wheel press, hydraulic.....*389
Wheel, sprocket, elliptical....135, 199
Wheel, water, Potsdam Co.'s....*38
Wheels, chain, magnetized.....212
Wheels, rear, double.....183
Where tin comes from.....391
Wind carrying off heat.....10
Windmill exhibit, Chicago.....*389
Window holder, car, Kirby's....*345
Wine and water, trick.....*276
Wire, barbed, French patent.....*283
Wire gun.....261
Wire guns.....311
Wire shafts for steamers.....122
Woman's noble act.....73
Wood dyeing, zinc in.....242
Woodpeckers, acorn eating.....7
Wood pulp.....154
Wood sawing machine.....*340
Wood, Sir E. Trueman.....*68
Work, 9 hours, for 10 hours' pay. 89
World's Congress Auxiliary.....178
Worm, chestnut.....55
Worms, wood carved by.....*148
Worsteds.....35
Wounds, antiseptic paper for....123
Wrench and cutter.....*277
Wrench, Kaltenbeck's.....*165
Wrench, Kraft's.....*117
Wrench, Wells'.....*356

Y

Yerkes, Charles T.....*54
Young, how to keep.....69
Yucatan exhibit at Fair.....217

Z

Zinc-eisen, magnesium.....231
Zinc in wood dyeing.....242

© 1893 SCIENTIFIC AMERICAN, INC

Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞ Our new and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

CHICAGO EXHIBITION

TO INVENTORS AND MANUFACTURERS

An old established English firm whose operations cover the whole of the United Kingdom of Great Britain and Ireland and portions of the Continent of Europe, with the aid of competent travelers calling on the best hardware dealers, ironmongers, storekeepers, ship chandlers, implement agents and seedsmen, etc., are prepared to buy for cash and handle vigorously (as sole agents) any American invention of proved excellence that comes within the scope of their business, for example, labor-saving appliances of domestic utility, implements for the dairy and garden, as well as improved machinery used in the manufacture of paints and colors.

The head of the firm will arrive in Chicago at the end of June, and remain there several weeks to negotiate business. Letters, with particulars, should be sent immediately, addressed to "CLIMAX," care SCIENTIFIC AMERICAN, New York.

Visitors to the WORLD'S FAIR

should inspect the handsome Registers, Sunshine Recorders, Anemometers, and other Meteorological apparatus on exhibit in Weather Bureau Building, from Julien P. Friez, 107 E. Ger. St., Baltimore, Md., U. S. A., who also manufactures Heliographs for U. S. Army and State Militias.

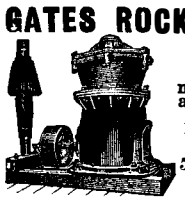
Write for Catalogue.

HOW TO KNOW THE WILD FLOWERS

A Guide to the names, haunts, and habits of our common Wild Flowers. By Mrs. Wm. Starr Dana. Illustrated by Marion Satterlee. Containing descriptions of more than 400 flowers, with 100 illustrations, 298 pages, square 12mo, cloth. $1.50, by mail, postpaid.

For sale by MUNN & CO.,
Publishers of SCIENTIFIC AMERICAN,
361 Broadway, New York.

GATES ROCK & ORE BREAKER



Capacity up to 200 tons per hour.

Has produced more ballast, road metal, and broken more ore than all other Breakers combined.

Builders of High Grade Mining Machinery. Send for Catalogues.

GATES IRON WORKS,
50 C So. Clinton St., Chicago
136 C, Liberty Street, New York.
237 C, Franklin St., Boston, Mass

$10.00 to $50.00 per night. A light and profitable business. **Magic Lanterns and Views** of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc.
L. MANASSE, 88 Madison Street, Chicago, Ill.

STEREOPTICONS. MAGIC LANTERNS AND ACCESSORIES. SEND FOR CATALOGUE TO CHAS BESELER MAKER 218 CENTRE ST. NEW YORK.

SCIENTIFIC EXPERIMENTS. — Description of some simple and easily performed scientific experiments. Foucault's pendulum, exchange of water and wine, the bird in the cage, the five-pointed star, the sum of the angles of a triangle, surface of the sphere, with 6 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 875. Price 10 cents. To be had at this office and from all newsdealers.

JUST PUBLISHED.

THE MANUFACTURE OF

Liquors and Preserves.

BY J. DE BREVANS.

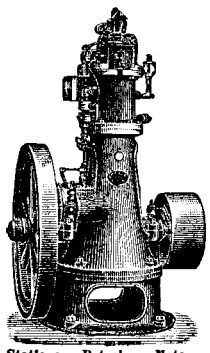
PRICE $3.00, POSTPAID.

The author is an eminent French chemist who has devoted much time and study to the preparation of Liquors and Preserves. The great value of the work consists in the formulas, which number over 300, and are so arranged that, if the manufacturer has no distilling plant of his own, he can still make many of the liquors from the essences. The manufacture of French *liqueurs*, etc., from essences is very profitable and does not require large capital. The raw materials, the plant of the distiller, etc., are described according to the best modern practice. The book has 65 illustrations, 18 tables, and a full index.

☞ *Send for Table of Contents.*

MUNN & CO., Publishers,
SCIENTIFIC AMERICAN OFFICE,
361 Broadway, New York.

PATENT PETROLEUM MOTORS. NO BENZINE



Stationary Petroleum Motor.

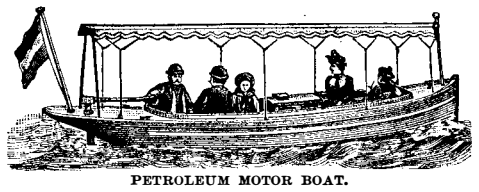
Specially adapted to run all kinds of machinery used in small industries, mills, small electric light plants, pumps, all kinds of vehicles, etc., etc. No Racer. Over 1500 motors already in use. Received awards at all Expositions. Motors of from ½ to 30 h. p. ready for delivery.

☞ Our Motors are exhibited at Columbian Exposition, Chicago, Section F, No. 1526.

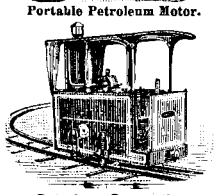
☞ *Send for Illustrated Catalogue and Price List, Free.*

J. M. GROB & CO., Mfrs. Leipzig-Eutritzsch, GERMANY.
First and largest Oil Engine Manufactory in Europe.

Portable Petroleum Motor.



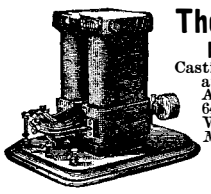
PETROLEUM MOTOR BOAT.



Petroleum Locomotive.

Inventions and Novelties Developed.

Manufacturers of Electrical Goods. Experimental and Repair Work. THE N. Y. ELECTRICAL AND DEVELOPMENT CO., 251 William Street, New York.



The New Palmer Fan MOTOR, Price $5.00.

Castings and Parts of all Motors and Dynamos described in SCI. AM. SUPPLEMENT, Nos. 161, 600, 641, 759, 767, 865; and the New Watson 1 h. p. Motor. *Telephone Materials.* Electrical Supplies. *Send stamp for catalogue.*

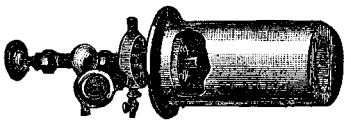
PALMER BROS.,
Mianus, Conn.

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electro motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

ABOUT MAGIC LANTERNS

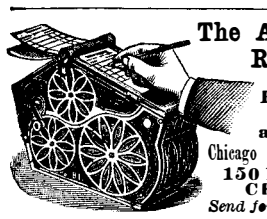
ASK US WE MAKE THEM.

J. B. COLT & CO.
16 BEEKMAN ST. 189 LA SALLE ST
NEW YORK CHICAGO, Ill.



THE "COLUMBIA"
CRUDE OIL BURNER and AIR INJECTOR
MANUFACTURED BY
SHIPMAN ENGINE MANUF'G CO., Rochester, N. Y.

AN IDEAL STUB PEN—Esterbrook's Jackson Stub, No. 442
A specially EASY WRITER, a GOOD INK HOLDER and a DELIGHT to those who use a STUB PEN. ASK YOUR STATIONER FOR THEM. Price, $1.00 per gross. THE ESTERBROOK STEEL PEN CO., 26 John St., New York.



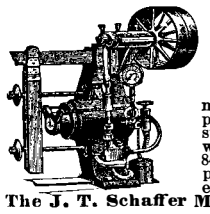
The AUTOGRAPHIC REGISTER.
A Labor-Saving Business System.
Enforcing Honesty and Accuracy.
Chicago Autographic Register Co.
150 E. Monroe Street, CHICAGO, ILL.
Send for catalogue & price list.

The Orcutt Comp'y Leading Lithographers Chicago.
W. B. ORCUTT, Gen'l Mgr. CORRESPONDENCE SOLICITED.

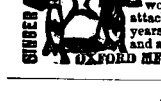
MAJOR'S CEMENT MENDS EVERYTHING
15 and 25 cents. At all Druggists or by Mail. **Major's Leather Cement** mends everything in leather. 10, 15 and 20c. **Major's Rubber Cement** repairs everything in rubber. 15c. A. MAJOR'S CEMENT CO., 232 William St., N. Y.

STORAGE BATTERIES. WRITE FOR PARTICULARS. STORAGE BATTERY SUPPLY CO. 23d ST & 1st AVE. NEW YORK.

CHOLERA: EPIDEMIOLOGY OF.—By Dr. G. Archie Stockwell. An interesting and valuable paper on the dissemination of the Asiatic Cholera, showing what does and what does not spread the disease. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 888. Price 10 cents. To be had at this office and from all newsdealers.



HYDRAULIC WHEEL PRESSES
A SPECIALTY.
Cut represents a single pump machine for belt power. This press is made in various sizes to swing car wheels and drive wheels, 30, 36, 42, 54, 66, 72, 78, and 84 inches. Single or double pumps as required, and for generating from 30 to 300 tons.
The J. T. Schaffer Mfg. Co., Rochester, N. Y.



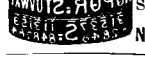
MY WIFE SAYS SHE CANNOT SEE HOW YOU DO IT FOR THE MONEY.
$12 Buys a $65.00 Improved Oxford Singer Sewing Machine; perfect working reliable, finely finished, adapted to light and heavy work, with a complete set of the latest improved attachments free. Each machine guaranteed for 5 years. Buy direct from our factory, and save dealers and agents profit. Send for FREE CATALOGUE.
OXFORD MFG. COMPANY, DEP'T D, 18 CHICAGO, ILL.

Made to fit any Pole Tip.

Safety Neck Yoke.
Economical, safe, durable and reliable. ☞ Patent for sale entire by States, or will arrange for manufacture on royalty. For sample and terms address
J. G. BURBRIDGE, Council Bluffs, Iowa

MILLER & VAN WINKLE
STEEL WIRE AND STEEL SPRINGS
TEMPERED STEEL WIRE
TEMPERED COMPRESSION & EXTENSION SPRINGS
A SPECIALTY
MACHINERY SPRINGS.
OFFICE & WORKS 18 TO 24 BRIDGE ST. BROOKLYN, N.Y.

STEEL TYPE FOR TYPEWRITERS



Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work.
Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N. Y

GREENERD ARBOR PRESS
DURABLE AND EFFICIENT.

Saves marring, upsetting, or springing the arbor. Saves cleaning out the centres and taking off the dogs.
No. 2, Weight 42 lbs., Net price, $13.
No. 3, " 90 lbs., " " 16.
☞ *Illustrated circular on application.*
CHANDLER & FARQUHAR,
179 Washington St., **Boston, Mass.**

JAPANNING, ENAMELING & DECORATING WRITE FOR PRICES. ON WOOD OR METAL. LARGEST AND MOST COMPLETE PLANT IN THE COUNTRY FOR THIS CLASS OF WORK. BICYCLE ENAMELING A SPECIALTY. AUTOMATIC M'F'G CO. COR. 57 ST. & 1 AVE. NEW YORK.

WOODEN TANKS. FOR RAILROADS, WATER WORKS, MILLS, FARMS &c. COMPLETE STOCK OF CYPRESS LUMBER.
LARGE WATER TANKS. PLANS & ESTIMATES A SPECIALTY. SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS.
W. E. CALDWELL CO.
No. 217 E. MAIN ST. LOUISVILLE KY.

Engineering School of the Western University of Pennsylvania
The leading Engineering School of Pennsylvania. Write for catalogue to
DANIEL CARHART, Dean,
Allegheny, Pa.

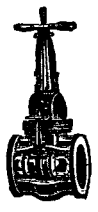
"ECONOMY IS WEALTH."
Agents wanted to sell the **Improved Hall Typewriter.** The only standard machine made for a reasonable price. Prints all languages. Interchangeable type.
☞ *Send for Catalogue.*
Address N. TYPEWRITER CO.
611 Washington Street, Boston, Mass.
Mention Scientific American,

If you want the best CHUCKS, buy Westcott's

Little Giant Double Grip Drill Chucks, Little Giant Drill Chucks Improved, Oneida Drill Chucks, Cutting-off Chucks, Scroll Combination Lathe Chucks, Geared Combination Lathe Chucks, Plain Universal Lathe Chucks, Independent Lathe Chucks. Made by
Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish, or German.

DELANEY'S Expansion Packings for Steam, Water & Ammonia are best and cheapest.
DELANEY'S Metallic Gaskets and Flanges make everlasting joints.
H. J. Delaney & Co. Mfrs.
Third & Fowler Sts., Milwaukee, Wis.

Family Ice Machine Ice, etc., in a few minutes, $10 and up. Filters, $1,25 and up. Cookers, $1. Seltzateurs to prepare one's self soda water, $4.50 and up. L. DERMIGNY, 126 W. 26th St. N. Y.



CHAPMAN VALVE MANUFACTURING COMPANY,
MANUFACTURERS OF
Valves and Gates
For STEAM, WATER, GAS, AMMONIA, OIL, ACID, Etc.; also GATE FIRE HYDRANTS.
We make a Specialty of Valves for Superheated and High Pressure Steam, 100 Pounds Pressure and Upwards.
General Office and Works, INDIAN ORCHARD, MASS.
Treasurer's Office, 72 KILBY STREET, BOSTON. Chicago Office, 24 WEST LAKE STREET.
☞ *All work Guaranteed* *Send for Circulars and Prices.*

8 FT. $25
12 FT. $50
16 FT. $100
AERMOTORS
ALL STEEL
GALVANIZED
PUMPING OR GEARED SAME PRICE.

For the benefit of the public, the Aermotor Company declares a dividend and makes the above prices as a means of distributing it. These prices will be continued only until its surplus earnings are sufficiently worked off. Merit has prospered, and a very small profit on a very great number of outfits has given the Aermotor Company 4 acres of land in the best manufacturing center of Chicago, with many, very many, acres of floor space and the best equipment of machinery, for the purpose, in existence. The Aermotor Co. feels, in this crowning Columbian year, that it can afford to be generous. We will ship from Chicago to any one anywhere at the above prices.

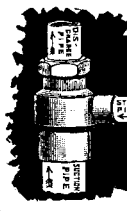
THE AERMOTOR COMPANY,
12th and Rockwell Sts., CHICAGO.

CHEAPER THAN WINDMILLS

ALWAYS READY. NO BOILER. NO FIRE. NO ENGINEER. NO LICENSE. NO DANGER. STATIONARY, MARINE AND PORTABLE ENGINES, FOR BOATS, PUMPS, FACTORIES ETC. SMALL SIZES A SPECIALTY.
SEND FOR CATALOGUE
SAFETY VAPOR ENGINE CO.
16 MURRAY ST. NEW YORK.

PROPOSALS.

SEALED TENDERS WILL BE RECEIVED BY the Government of Newfoundland, addressed to the Colonial Secretary, on or before the 15th day of August next, for a lease of the St. John's First Class Simpson's Improved Dry Dock, and of the harbor works in connection therewith, for a term of ten, fifteen or twenty years. The Dry Dock is 620 feet in extreme length, with a draft of 25 feet of water on the sill at high tide. It is built of concrete, pitch pine and oak, and is in good condition. The property is equipped on one side of the dock with all necessary repair, shop and office accommodation, in a brick building 400 feet long, 30 feet wide and 16 feet height of wall. The shop is provided with 1 vertical drill, 1 punch and shears, 1 set plate rolls, electric light plant, and engine and boiler, with necessary shafting. In separate brick building, on the same side of the dock, is the pumping installation, consisting of two W. H. Allan's 30-inch centrifugal pumps (direct acting horizontal engines) and one 10-inch centrifugal (engine, compound, double, vertical), all supplied by a pair of marine boilers. The gate is a floating iron caisson, provided with steam warping capstan and steam ballast pump. Tenders must state term of years proposed, rent and securities for performance of contract. Further particulars may be had on application to me.
R. BOND, Colonial Secretary, St. John's, Newfoundland.—25th May, 1893.



VANDUZEN STEAM JET PUMP
THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
10 SIZES.
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE VANDUZEN & TIFT CO.,
102 to 108 E. Second St., Cincinnati, O.

WATER WHEELS JAMES LEFFEL & CO., SPRINGFIELD, OHIO, U.S.A.
Send for our fine large PAMPHLET.

MALLEABLE AND FINE GRAY IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS
THOMAS DEVLIN & CO. FINE TINNING, JAPANNING AND FINISHING.
LEHIGH AVE. & AMERICAN ST. PHILA.

$25 to $50 per week, to Agents, Ladies or Gentlemen, using or selling "Old Reliable Plater." Only practical way to replate rusty and worn knives, forks, spoons, etc; quickly done by dipping in melted metal. No experience, polishing or machinery. Thick plate at one operation; lasts 5 to 10 years; fine finish when taken from the plater. Every family has plating to do. Plater sells readily. Profits large.
W. P. Harrison & Co., Columbus, O.

FOR SALE.—Volumes 1 to 40 inclusive, Scientific American, complete. Well bound, good order. Price $80. G. W. Pearsons, cor. 5th St. & Troup Av., Kansas City, Kan

ALANSON CARY MANUFACTURER OF **STEEL SPRINGS** OF EVERY DESCRIPTION
240 & 242 W. 29TH ST. NEW-YORK

FREE.
A fine 14k goldplated watch to every reader of this paper. Cut this out and send it to us with your full name and address, and we will send you one of these elegant, richly jeweled, gold finished watches by express for examination, and if you think it is equal in appearance to any $25.00 gold watch, pay our sample price, $3.50, and it is yours. We send with the watch our guarantee that you can return it at any time within one year if not satisfactory, and if you sell or cause the sale of six we will give you ONE FREE. Write at once, as we shall send out samples for 60 days only.
THE NATIONAL M'F'G & IMPORTING CO.,
334 Dearborn St., Chicago, Illinois.

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti. O.

© 1893 SCIENTIFIC AMERICAN, INC

Advertisements.

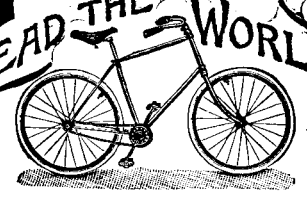
ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Victors Lead the World

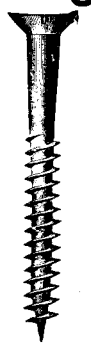


OVERMAN WHEEL CO.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.

A. G. SPALDING & BROS., Special Agents,
CHICAGO. NEW YORK. PHILADELPHIA.

COLD FORGED PRODUCT.

Forged Wood Screw



Patented May 10, July 19, 1887; Oct. 29, 1889; Aug. 19, Oct. 21, 1890; April 7 May 12, 1891; July 19, 1892.

Its Advantages are:

1. Stronger than a common screw.
2. Uniform and wide slot.
3. Requires the use of but one bit in hard wood.
4. Inserted easier.
5. Centralized point.
6. Superior holding power.
7. The screw being **Cold Forged**, instead of **Cut**, leaves on its entire surface a metallic skin.

☞ Send for samples to

AMERICAN SCREW CO.
PROVIDENCE, R. I.

THE WILMOT & HOBBS MFG. COMPANY

ESPECIALLY SOLICIT ORDERS FOR SOFT AND EXTRA SOFT PLAIN BLUE FINISH OR ANNEALED OR PICKLED
HOT ROLLED BAND, STRIP AND PLATE STEEL.
GREAT ACCURACY OF GAUGE WIDTH AND UNIFORMITY OF QUALITY WILL ALWAYS BE MAINTAINED
ALSO THE CELEBRATED BRIGHT SURFACE AND ANNEALED
COLD ROLLED SHEET AND STRIP STEEL
LARGE CONTRACTS SOLICITED FOR AUTOMATIC, HEAVY & DIFFICULT SHEET METAL BLANKED, STAMPED & DRAWN WORK, TUBES &c. NICKEL & BRASS PLATING, TINNING, JAPANNING & DIE MAKING. BRIDGEPORT, CONN.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's ☞ Book of SAWS, new 1892 edition. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Limited), Beaver Falls, Pa. **SAWS**

RIEDLER PUMPING ENGINES AND AIR COMPRESSORS ARE POSITIVELY BETTER THAN ANY OTHERS UPON THE MARKET.
FOR EVIDENCE OF THIS FACT WRITE FOR PARTICULARS TO
FRASER & CHALMERS
133 FULTON ST. W. CHICAGO, ILL.

Boiled baby

was the preference of Charles Lamb.

A lady asked him: "How do you like babies?" He replied: "Boiled, madam." This bachelor sarcasm perhaps arose from the idea of some fond parents that fine clothes make a fine baby; they don't. It is the little fellow inside of the clothes, who has only one tooth and a spectacular smile, dimpling off at the ends of his toes. Pretty dress completes the charm—as it does with everything. Even a watch should have a handsome outside; but the main point is the *time* it keeps. You find all this in the new, **quick-winding** Waterbury.

All jewelers sell it. All styles, $4 to 15. 47

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-five years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—Nos. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

"IMPROVEMENT THE ORDER OF THE AGE."

The Smith Premier Typewriter

Embodies the most Progressive Mechanical Principles.
All the Essential Features Greatly Perfected.
Perfect and Permanent Alignment.
Easiest Running, and Nearly Silent.
All type cleaned in Ten Seconds without Soiling the Hands.

The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.

We have 20 branch offices in the principal cities throughout the United States.

Send for Catalogue.

No one ever wrote **1000 Letters** an Hour,

that is, unless they first wrote one and then copied the rest on an

EDISON MIMEOGRAPH

Invented by Thos. A. Edison. For Daily Office Use in duplicating both handwriting and typewriting Anybody can operate it. Simple—Compact—Cleanly—Cheap. **Endorsed by over 90,000 users.** Catalogues and Samples of Work sent free upon application. Manufactured only by the **A. B. DICK CO., 154 E. Lake St. Chicago.** Branch Offices, 47 Nassau St., N. Y. City, 117 So. Fifth St., Phila.

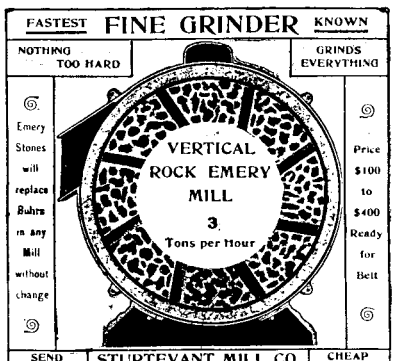
KODAKS.

Take one with You to the World's Fair.

They're the only practical camera for the purpose. No bulky glass plates—no troublesome holders—no need of hunting up a dark room. With our special Columbian spools of film, containing 200 exposures you can have your Kodak loaded before leaving home and can then "*press the button*" as often as you like, while at the Fair without the necessity of reloading.

Eastman Kodak Co.,
Send for Catalogue. Rochester, N. Y.

FASTEST FINE GRINDER KNOWN


NOTHING TOO HARD
GRINDS EVERYTHING
Emery Stones will replace Burrs in any Mill without change
VERTICAL ROCK EMERY MILL
3 Tons per Hour
Price $100 to $400 Ready for Belt
SEND FOR CIRCULAR
STURTEVANT MILL CO. Boston, Mass.
CHEAP HARD DURABLE

H. W. JOHNS' Liquid Paints

These Paints are composed of pure linseed oil and the highest grade of pigments. They are combined by processes exclusively our own and are unequaled by any in richness and permanency of color. One gallon will cover from 275 to 300 square feet, two coats without thinning and can be safely thinned with ½ gallon linseed oil to one gallon paint for first coat.

SAMPLE CARD OF 56 SHADES, INSTRUCTIONS FOR USE AND SUGGESTIONS FOR PAINTING ETC. FREE BY MAIL.

NEW YORK JERSEY CITY CHICAGO PHILADELPHIA BOSTON ATLANTA

H. W. JOHNS M'F'G. CO.

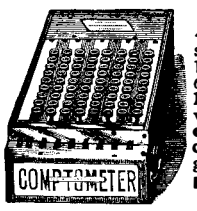
ZINC ETCHING
HALFTONE PROCESS

Printer Engravings

OF MAGAZINES, BOOKS, SOUVENIRS.

CATALOGUE WORK A SPECIALTY

A. H. KELLOGG
SCOTT & BOWNE BUILDING
New York.



ALL ARITHMETICAL PROBLEMS solved rapidly and accurately by the Comptometer. Saves 60 per cent of time and entirely relieves mental and nervous strain. Adapted to all commercial and scientific computation. Why don't you get one? *Write for pamphlet.*
FELT & TARRANT MFG. CO.
52-56 ILLINOIS ST. CHICAGO.

AGENTS WANTED WRITE FOR CATALOGUE & AGENCY. FOR **FINE TOOLS** IN EVERY SHOP.
C. H. BESLY & CO.
CHICAGO, ILL. U.S.A.

$20 Buy Direct and Save 50 Per Cent.

All riders say they cannot see how we can do it for the money: $20 buys an elegant Oxford finely finished and nickel plated Bicycle, warranted to be first class, simple in construction, strong, durable and accurately fitted, which makes riding on our Wheel a pleasure instead of hard work; material we use is of the highest grade, each wheel guaranteed. Write to-day for our illustrated FREE catalogue.
DEPT. B.—OXFORD MFG. CO. 338 WABASH AVE. CHICAGO.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made, how to apply the written letter to the pad, how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

SEND FOR OUR CIRCULAR.

IN ONE MINUTE

IT WILL CONVINCE YOU OF OUR ABILITY TO SUPPLY TOILET PAPER FOR LESS MONEY THAN IT CAN BE OBTAINED ELSEWHERE. **A.P.W. PAPER CO.** ALBANY, N.Y.

COMPLETE ELECTRICAL EQUIPMENTS
—FOR—
ARC OR INCANDESCENT LIGHTING.

Arc Lamps. Incandescent Lamps. House Wiring Appliances.

MINIATURE ·.· LAMPS ·.· FOR ·.· DECORATIVE ·.· PURPOSES.

GENERAL ELECTRIC COMPANY,
DISTRICT OFFICES:

44 Broad Street.....New York.
173 and 175 Adams Street.....Chicago, Ill.
Fifth and Race Streets.....Cincinnati, O.
Equitable Building.....Atlanta, Ga.
15 First Street.....San Francisco, Cal.
620 Atlantic Avenue.....Boston, Mass.
509 Arch Street.....Philadelphia, Pa.
401-407 Sibley Street.....St. Paul, Minn.
1333 F Street, N. W.....Washington, D. C.
Masonic Temple.....Denver, Colo.

All business outside the U. S. transacted by Thomson-Houston International Electric Co. 44 Broad St. New York

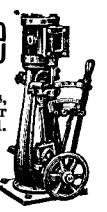
CASH PAID for all kinds of good Second-hand Iron and Wood-Working Machinery. Address W. P. DAVIS, ROCHESTER, N. Y.

Three Columbias

There is something about Columbias different from all other bicycles—it is superlative quality—The Columbia guarantee is as good as gold.

Catalogue free at Columbia agencies, by mail for two two-cent stamps. Pope Mfg. Co., Boston. New York, Chicago, Hartford.

Greenfield Yacht Engine



3 to 5 H. P. Price $120.

Thoroughly adapted for Steam Launches, Pleasure Yachts, Tug Boats, and other small steamers. Simple and easily managed. Occupies very small space. 19 years on the market. ☞ *Send for Circulars.*

W. G. & G. GREENFIELD,
EAST NEWARK, N. J.

LINK-BELT MACHINERY CO.
Engineers, Founders, and Machinists,
CHICAGO.

Exclusive manufacturers of the **Original Ewart Link Belting.** Made in 31 regular sizes.
Sprocket Wheels.
Machinery for handling all kinds of Freight, Cereals, Ores Refuse, etc. Manila Rope Power Transmissions, Shafting, Pulleys, Hangers, Gearing, Sheaves, Fly Wheels, etc.

PATTERN MAKER, H. VAN SANDS, 144 Centre St., N. Y.

THE CHASE WOOD RIM PULLEY

ALL IRON RIM EXCEPT THE
BORED TO SHAFT SIZE. KEYSEATS AND SET SCREWS SAME AS AN ALL IRON PULLEY. LARGE PULLEYS FOR ANY AMOUNT OF HORSE POWER
A SPECIALTY. SEND FOR DESCRIPTIVE CIRCULAR TO
F. A. CHASE & CO. MFR'S. 7 EDDY ST. PROVIDENCE R.I.

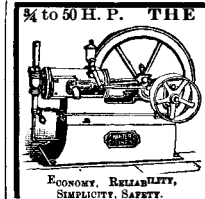
The American Bell Telephone Company
125 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

¾ to 50 H. P. **THE Motor of 19th Century**



Can be used *any place*, to do *any work*, and by *any one*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address
CHARTER GAS ENGINE CO.
P. O. Box 148. Sterling, Ill.

PRINTING INKS.

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lomoard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1893 SCIENTIFIC AMERICAN, INC